CellPath™ 300 ATM WAN Multiplexer User's Manual

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Software Version 1.3

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Legal Notices

FCC CLASS A NOTICE

WARNING: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void this user's authority to operate this equipment.

NOTE: The *CellPath*™ 300 has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of the equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

DOC CLASS A NOTICE

This digital apparatus does not exceed Class A limits for radio noise emission for a digital device as set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la class A prescrites dans le reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

FCC REQUIREMENTS (Notice to Users of T1 Service)

The following instructions are provided to ensure compliance with the Federal Communications Commission (FCC) Rules, Part 68.

This device may be connected to the T1 network.

Before connecting your unit, you must inform the telephone company of the following information:

SOC	FIC	USOC
6.0N	04DU9-1SN	RJ48C

If the unit appears to be malfunctioning, it should be disconnected from the telephone lines until you learn if your equipment or the telephone line is the source of the trouble. If your equipment needs repair, it should not be reconnected until it is repaired.

If the telephone company finds that this equipment is exceeding tolerable parameters, the telephone company can temporarily disconnect service, although they will attempt to give you advance notice if possible.

Under the FCC Rules, no customer is authorized to repair this equipment. This restriction applies regardless of whether the equipment is in or out of warranty.

If the telephone company alters their equipment in a manner that will affect use of this device, they must give you advance warning so as to give you the opportunity for uninterrupted service. You will be advised of your right to file a complaint with the FCC.

CE NOTICE

Marking by the symbol **CE** indicates compliance of this system to the EMC (Electromagnetic Compatibility) directive of the European Community and compliance to the Low Voltage (Safety) Directive. Such marking is indicative that this system meets or exceeds the following technical standards:

- EN 55022 - "Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment."
- EN 50082-1 - "Electromagnetic compatibility - Generic immunity standard Part 1: Residential, commercial, and light industry."
- IEC 1000-4-2 - "Electromagnetic compatibility for industrial-process measurement and control equipment Part 2: Electrostatic discharge requirements." - Severity level 3.
- IEC 1000-4-3 - "Electromagnetic compatibility for industrial-process measurement and control equipment Part 3: Radiate electromagnetic field requirements." - Severity level 2.
- IEC 1000-4-4 - "Electromagnetic compatibility for industrial-process measurement and control equipment Part 4: Electrical fast transient/burst requirements." - Severity level 2.

CERTIFICATIONS

ETL certified to meet Information Technology Equipment safety standards UL 1950, CSA 22.2 No. 950, and EN 60950.

CANADIAN IC CS-03 COMPLIANCE STATEMENT

NOTICE: The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Industry Canada label does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

VCCI CLASS 1 NOTICE

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従って、住宅地域またはその隣接した地域で使用すると、ラジオ、テレビジョン受信機等に受信障害を与えることがあります。
取扱説明書に従って正しい取り扱いをして下さい。

This equipment is in the Class 1 category (information equipment to be used in commercial and/or industrial areas) and conforms to the standards set by the Voluntary Control Council For Interference by Information Technology Equipment aimed at preventing radio interference in commercial and/or industrial areas. Consequently, when used in a residential area or in an adjacent area thereto, radio interference may be caused to radios and TV receivers, etc. Read the instructions for correct handling.

TRADEMARKS

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Preface

The intent of this manual is to supply users of the *CellPath*™ 300 ATM WAN Multiplexer with general information on the *CellPath* 300. This document provides general product information, an explanation of ATM including an overview of ATM connections, network configuration information, and information about software administration capabilities. This document was created for users with various levels of experience. If questions or problems with the installation arise, please contact FORE Systems' Technical Support.

Chapter Summaries

Chapter 1 - Introduction - Provides an explanation of the different applications suited to the *CellPath* 300, an architectural overview, and traffic and network management information.

Chapter 2 - Basic ATM Theory - Explains ATM cells providing an overview of ATM connections, and an explanation of bandwidth management.

Chapter 3 - CellPath 300 Operation - Describes how the *CellPath* 300 processes traffic through the Protocol Modules (PMs) and Physical Layer Modules (PLMs). A description of how the *CellPath* 300 utilizes Frame Relay Link Management (FRLM) and Inverse Multiplexing over ATM (IMA) is also provided.

Chapter 4 - Login Procedure - Describes the procedures required to log into and out of the *CellPath* 300, including access privileges.

Chapter 5 - User Interface - Describes the *CellPath* 300 user interface, including the hierarchy of screens, traversing the screens, making selections in the screens, and configuring values in screens.

Chapter 6 - Configuring Ports - Provides step-by-step procedures to configure individual ports on the *CellPath* 300.

Chapter 7 - Configuring for Remote Access- Provides step-by-step procedures to configure the *CellPath* 300 so that it can be accessed remotely for network management.

Appendix A - Specifications - Provides specifications of the *CellPath* 300 and supported Protocol (PM) and Physical Layer Modules (PLM). Provides a PM / PLM compatibility list.

Acronyms - Provides a listing of commonly-used networking and ATM terms.

Glossary - A glossary is provided to describe the many acronyms and terms used in the networking and ATM community and throughout this manual.

Technical Support

In the U.S.A., you can contact FORE Systems' Technical Support using any one of the following methods:

1. If you have access to the Internet, you may contact FORE Systems' Technical Support via e-mail at:

   support@fore.com

2. You may telephone your questions to "support" at:

   800-671-FORE or 724-635-3700

3. You may FAX your questions to "support" at:

   724-742-7900

4. You may send questions, via U.S. Mail, to:

   FORE Systems, Inc.
   1000 FORE Drive
   Warrendale, PA 15086-7502

Technical support for non-U.S.A. customers should be handled through your local distributor.

No matter which method is used for support, please be prepared to provide your support contract ID number, the serial number(s) of the product(s), and as much information as possible describing your problem / question.

Typographical Styles

Throughout this manual, all specific commands meant to be entered by the user appear on a separate line in bold typeface. In addition, use of the `Enter` or `Return` key is represented as `<ENTER>`. The following example demonstrates this convention:

`cd /usr <ENTER>`

File names that appear within the text of this manual are represented in the following style: "...the `fore_install` program installs this distribution."

Command names that appear within the text of this manual are represented in the following style: "...using the **`flush-cache`** command clears the bridge cache."

Subsystem names that appear within the text of this manual are represented in the following style: "...to access the **`bridge`** subsystem..."

Parameter names that appear within the text of this manual are represented in the following style: "...using *`<seg-list>`* allows you to specify the segments for which you want to display the specified bridge statistics."

Any messages that appear on the screen during software installation and network interface administration are shown in `Courier` font to distinguish them from the rest of the text as follows:

```
.... Are all four conditions true?
```

Important Information Indicators

To call attention to safety and otherwise important information that must be reviewed to insure correct and complete installation, as well as to avoid damage your system, FORE Systems utilizes the following *WARNING/CAUTION/NOTE* indicators.

WARNING statements contain information that is critical to the safety of the operator and/or the system. Do not proceed beyond a **WARNING** statement until the indicated conditions are fully understood or met. This information could prevent serious damage to the operator, the system, or currently loaded software, and will be indicated as:

WARNING!

Hazardous voltages are present. To lessen the risk of electrical shock and danger to personal health, follow the instructions carefully.

Information contained in **CAUTION** statements is important for proper installation/operation. **CAUTION** statements can prevent possible equipment damage and/or loss of data and will be indicated as:

CAUTION

You risk damaging your equipment and/or software if you do not follow these instructions.

Information contained in **NOTE** statements has been found important enough to be called to the special attention of the operator and will be set off from the text as follows:

Steps 1, 3, and 5 are similar to the installation for the computer type above. Review the previous installation procedure before installation in your particular model**.**

Laser Warning

Class 1 Laser Product:
This product conforms to applicable requirements of 21 CFR 1040 at the date of manufacture.

Class 1 lasers are defined as products which do not permit human access to laser radiation in excess of the accessible limits for Class 1 for applicable wavelengths and durations. These lasers are safe under reasonably foreseeable conditions of operation.

The *CellPath* 300 OC-3c / STM1 single-mode physical layer modules contain Class 1 lasers.

Safety Agency Compliance

This preface provides safety precautions to follow when installing a FORE Systems, Inc., product.

Safety Precautions

For your protection, observe the following safety precautions when setting up your equipment:

- Follow all warnings and instructions marked on the equipment.
- Ensure that the voltage and frequency of your power source matches the voltage and frequency inscribed on the equipment's electrical rating label.
- Never push objects of any kind through openings in the equipment. Dangerous voltages may be present. Conductive foreign objects could produce a short circuit that could cause fire, electric shock, or damage to your equipment.

Symbols

The following symbols appear in this book.

WARNING!

Hazardous voltages are present. If the instructions are not heeded, there is a risk of electrical shock and danger to personal health.

CAUTION

If instructions are not followed, there is a risk of damage to the equipment.

Modifications to Equipment

Do not make mechanical or electrical modifications to the equipment. FORE Systems, Inc., is not responsible for regulatory compliance of a modified FORE product.

Placement of a FORE Systems Product

CAUTION

To ensure reliable operation of your FORE Systems product and to protect it from overheating, openings in the equipment must not be blocked or covered. A FORE Systems product should never be placed near a radiator or heat register.

Power Cord Connection

WARNING!

FORE Systems products are designed to work with single-phase power systems having a grounded neutral conductor. To reduce the risk of electrical shock, do not plug FORE Systems products into any other type of power system. Contact your facilities manager or a qualified electrician if you are not sure what type of power is supplied to your building.

WARNING!

Your FORE Systems product is shipped with a grounding type (3-wire) power cord. To reduce the risk of electric shock, always plug the cord into a grounded power outlet.

CHAPTER 1 Introduction

The *CellPath* 300 ATM Access Multiplexer (Figure 1.1) is a multiport device that accepts an incoming communications stream, converts it to ATM cells, and cross-connects it to one or more output ports. Incoming traffic can be ATM cells, packets, or constant bit rate communications. Before the traffic exits the *CellPath* 300, it is either converted back to its original format or is left as ATM cells.

The *CellPath* 300 can cross-connect traffic between any two ports (assuming the ports have been configured with compatible protocols). Typically, this functionality is used to convert various types of traffic to ATM cells so that they can be concentrated on one or more ATM trunk lines. The "any-to-any" port connectivity also makes local traffic connectivity possible.

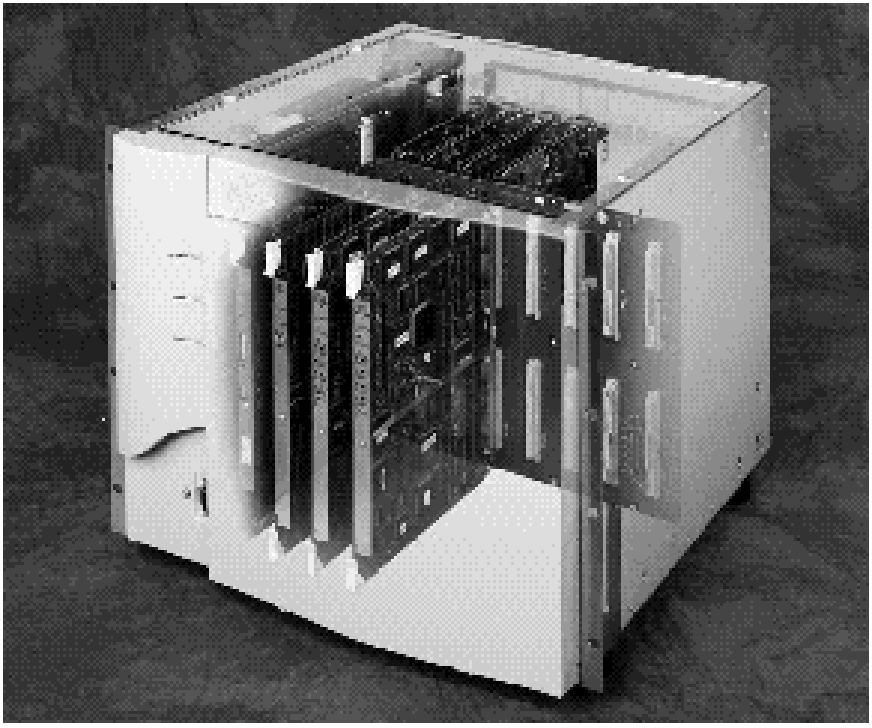

Figure 1.1 - *CellPath* 300: Migrating to ATM Technologies

The architecture of the *CellPath* 300 is built around an ATM cell-bus midplane in which physical modules and protocol modules are inserted to support various combinations of communication protocols and physical line types. This modular design allows the *CellPath* 300 to be customized to meet the needs of the specific site.

The *CellPath* 300 features traffic management that can control traffic flow to meet site requirements. Traffic management includes both early packet discard (EPD) and partial packet discard (PPD) for virtual channel connections.

1.1 Cell-bus Midplane Architecture

A modular architecture centered on an ATM cell-bus midplane offers the flexibility to build the system desired.

The *CellPath* 300 is based on an ATM cell-bus midplane into which various module combinations can be inserted to build the system to support the needs of the site. Each *CellPath* 300 has a System Controller module and an Extension module in the first slot. The remaining seven slots can be filled with any of the other available modules, see Figure 1.2. Modules can be replaced without disrupting traffic traveling over other modules.

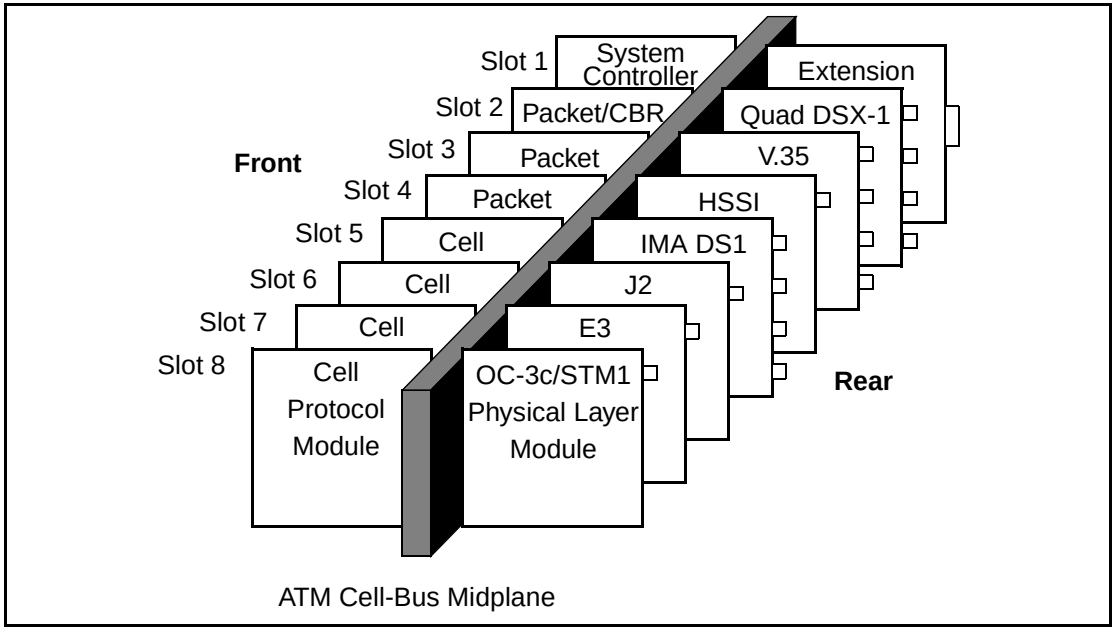

Figure 1.2 - *CellPath* 300 Modular Design

Modules function in pairs, refer to Figure 1.3. Each slot contains a protocol module (PM) in the front and a physical layer module (PLM) in the rear, combining to support the protocols over various line types.

Protocol / Physical Layer	V.35/ EIA-530	HSSI	DSX-1/ E1	IMA DS1/ IMA E1	DS3/ E3	J2	OC-3c/STM1 (single/multi-mode)
ATM UNI			✔	✔	✔	✔	✔
ATM DXI	✔	✔	✔		✔	✔	
Frame Relay	✔	✔	✔		✔	✔	
HDLC	✔	✔	✔		✔	✔	
CBR (circuit emulation)	✔		✔				

Figure 1.3 - Protocol / Physical Layer Combinations

1.2 Any-to-Any Port Connectivity

Any-to-any port connectivity means connections can be configured between any two ports, assuming the protocols are compatible. Figure 1.4 shows an example of a typical application. The *CellPath* 300 is installed at a customer premise to concentrate traffic of various types over a single ATM feed provided by a carrier. The customer premise has two routers, an ATM switch, a video codec, and a PBX, all directing traffic through the *CellPath* 300 and out to the carrier's line.

Besides the cross-connections to the ATM feed, the routers and ATM switch also have some cross-connections to each other. This feature is sometimes referred to as "local traffic connectivity." With concentrators that do not have local traffic connectivity, the only way to cross-connect local devices is to send the traffic out to the public network and have the carrier make the cross-connection. This is more costly and less efficient.

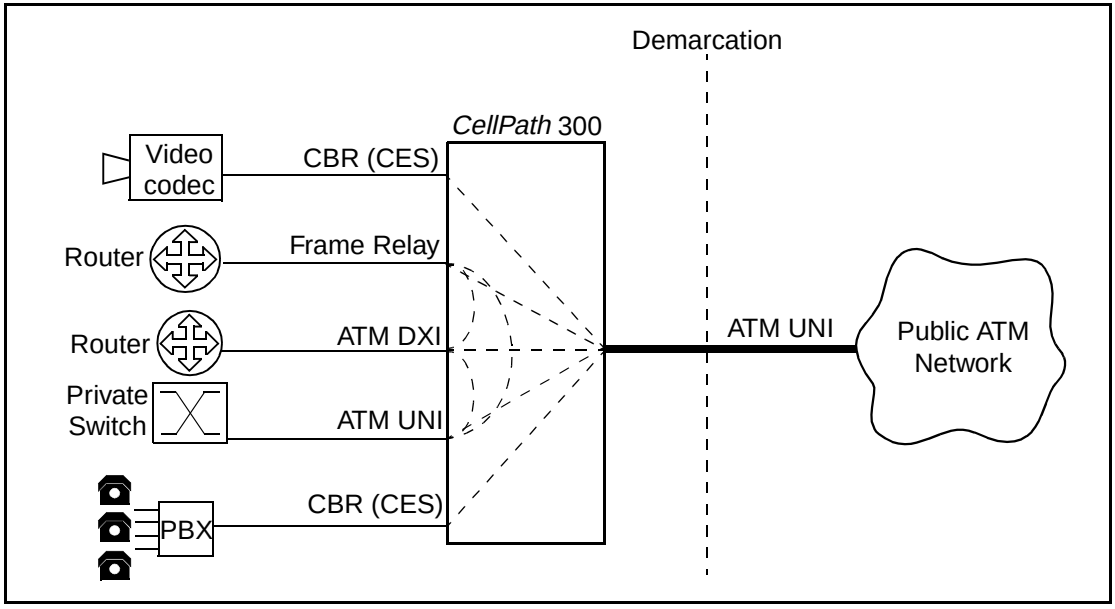

Figure 1.4 - *CellPath* 300's Any-to-Any Port Connectivity

NOTE

Figure 1.4 shows a typical setup. It does not represent every type of interface the *CellPath* 300 supports.

1.3 Traffic Management on the *CellPath* 300

Traffic management comprises three functions: traffic shaping, enforcement, and congestion management.

1.3.1 Traffic Shaping

Traffic shaping refers to the way the *CellPath* 300 manages the characteristics of traffic exiting the *CellPath* 300. (This is sometimes referred to as *egress* traffic.) The *CellPath* 300 features two capabilities with regard to traffic shaping: rate control and traffic smoothing.

1.3.1.1 Rate Control

For each VBR connection, whether it is a virtual path connection or a virtual channel connection, the *CellPath* 300 maintains a peak cell rate (PCR). Any traffic that exceeds the PCR is discarded. Each connection also has a sustainable cell rate (SCR). When the port is not congested, traffic exiting the *CellPath* 300 on a VBR connection is allowed to exceed the SCR, but is never allowed to exceed the PCR. Maximum burst size is 225 cells.

1.3.1.2 Traffic Smoothing

For a CBR connection, the *CellPath* 300 minimizes cell delay variation when converting CBR traffic into ATM cells by scheduling cell emission. For a VBR connection, smoothing is done on a per-slot basis. For example, if traffic enters the *CellPath* 300 on a T1 line and exits on a DS3 line, the *CellPath* 300 ensures that it leaves the *CellPath* 300 at T1 rates.

1.3.2 Enforcement (Policing)

Enforcement refers to how the *CellPath* 300 handles traffic entering the *CellPath* 300 (*ingress* traffic). For cross-connections between two ATM UNI ports (i.e., two cell ports), the *CellPath* 300 implements usage parameter control (UPC) for each connection on the port. UPC is implemented as configurable parameters that allow specifying the acceptable peak cell rate, the sustainable cell rate, and the priority of each connection.

For connections between a UNI port and a CBR or packet port, the *CellPath* 300 maintains latency buffers that handle the traffic conversion. When CBR traffic exceeds the configured bandwidth, these buffers overflow and cells are discarded.

1.3.3 Congestion Management

Congestion management refers to the way the *CellPath* 300 handles congestion on VBR connections. For each connection, both virtual path connections and virtual channel connections, the *CellPath* 300 maintains a priority, SCR, and PCR. During times of congestion, the *CellPath* 300 reduces the bandwidth to the SCR, based on the priority of the connection.

1.3.3.1 Early Packet Discard and Partial Packet Discard

For virtual channel connections (but not virtual path connections), the *CellPath* 300 uses early packet discard and partial packet discard to help keep throughput as high as possible. These two features maximize the efficiency of traffic discard, which occurs when a channel connection exceeds the configured bandwidth or during times of severe congestion. See Section 3.5 for a description of how these features work.

1.4 Network Management

The *CellPath* 300 can be managed remotely using the embedded SNMP agent and extensive MIBs. There are three ways to access the *CellPath* 300 for network management: in-band, over Ethernet, or through the communications port.

The *CellPath* 300 has an embedded SNMP agent, compatible with most SNMP-based management systems such as *ForeView*. A native SNMP agent is used for all management functions; even the *CellPath* 300 internal user interface uses the SNMP agent to manage the *CellPath* 300 (see Figure 1.5). This guarantees that all functionality in the user interface can be replicated using third-party network management software that supports SNMP.

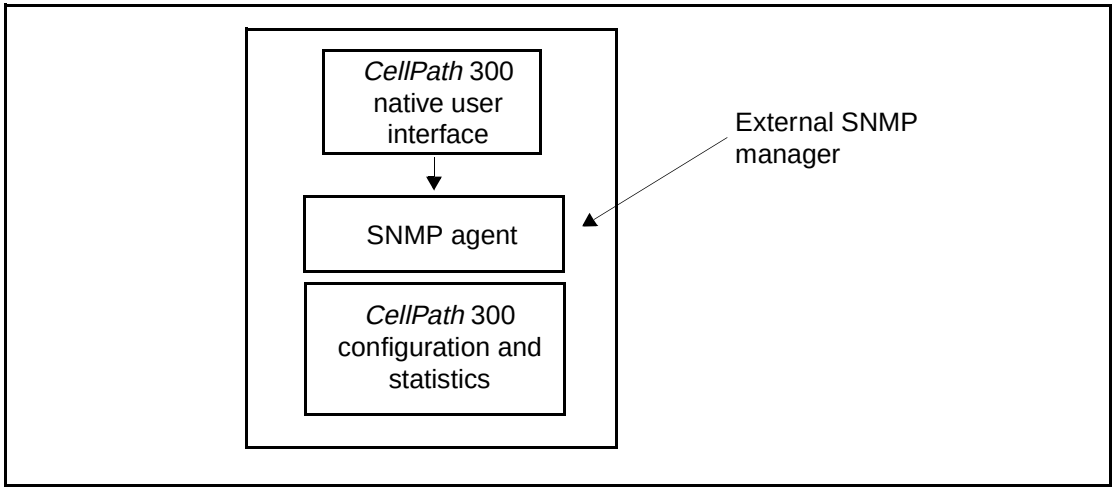

Figure 1.5 - *CellPath* 300 Management

The *CellPath* 300 features three access methods for network management: Ethernet, in-band connections, and a communications port (see Figure 1.6). The Ethernet access and in-band connections provide Telnet access, which you can use either to log into the proprietary interface or for communication between a third-party network management system and the SNMP agent. The Ethernet access is available through an optional PCMCIA slot. The in-band access is available through any port supporting AAL5 over ATM DXI, Frame Relay, or ATM UNI.

The communications port provides a way to connect a terminal to the *CellPath* 300 for accessing the proprietary interface. The communication port, which is useful for initial setup and access, supports a VT100 and the Sun shelltool with the appropriate terminal emulation software.

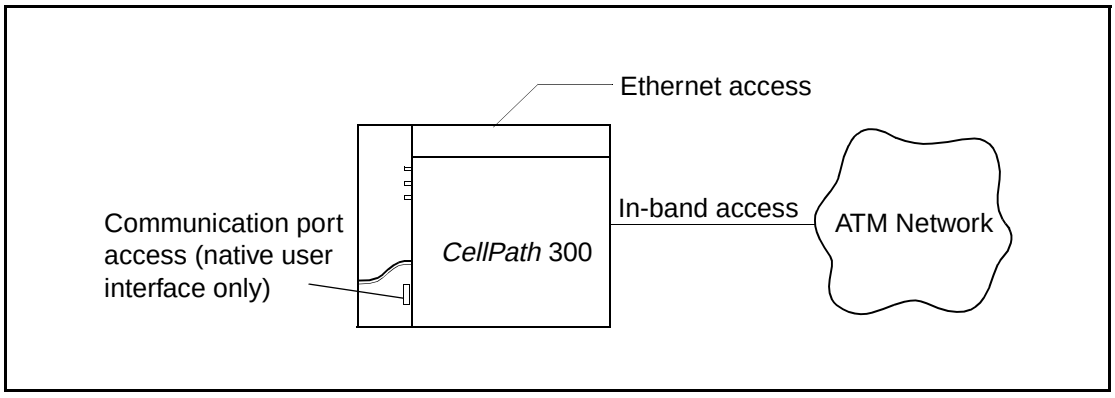

Figure 1.6 - *CellPath* 300 Communications Port Management

CHAPTER 2 Basic ATM Theory

This chapter describes basic ATM theory. It provides a framework of information that is helpful in understanding the features of the *CellPath* 300 and how to use them.

The topics covered are:

- ATM cells
- Virtual connections: paths and channels
- Routing cells
- Configuring cross-connections
- ATM bandwidth management (refer to Section 2.6 for information on how the *CellPath* 300 handles dynamic bandwidth)

2.1 ATM Integrates Various Traffic Types

Voice, video, and data network traffic each have special transmission requirements. With ATM, it is possible to integrate these various traffic types in a single network. For instance, voice and video are both time critical; traffic must be delivered quickly and at a constant rate. Variations in the delivery speeds or discarded data adversely affect the sound of the voice or the quality of the video image. Unlike data traffic, it is not acceptable (or possible) to retransmit bits of voice or video traffic. This type of traffic is referred to as constant bit rate (CBR) traffic.

Data network traffic is usually not time-critical and is bursty. For instance, when sending mail or accessing a database, the network traffic increases while the files are being transmitted, then subsides. If the file is not transferred instantaneously or smoothly, it is usually just a minor annoyance, or possibly not even noticed. Data traffic often is transferred in packets. If a packet is lost due to network congestion, it is retransmitted. This type of traffic is referred to as variable bit rate (VBR) traffic.

Some types of data traffic, such as echoing characters between a terminal and remote system, are time critical, and the ability to control latency is critical to achieve acceptable performance.

With ATM, all traffic types can be carried by a single network (see Figure 2.1). This is accomplished by segmenting all types of traffic into cells of equal length, then transmitting the cells through the same ATM network. The cells are multiplexed in such a way that the different traffic types are carried in individual “virtual connections.” Each virtual connection has the characteristics required to serve the traffic on the connection.

Figure 2.1 - ATM Technology Integration

2.2 ATM Cells

In ATM, cells are the basic unit of information. Unlike packets, cells have a fixed length. The ATM adaptation layers convert non-ATM traffic into ATM cells and vice versa so that existing networks can interface with ATM technologies without requiring the replacement of existing equipment.

All cells are 53 octets long, with 5 bytes dedicated to the header and the other 48 dedicated to data payload. Any traffic transmitted across an ATM network must be segmented and loaded into ATM cells.

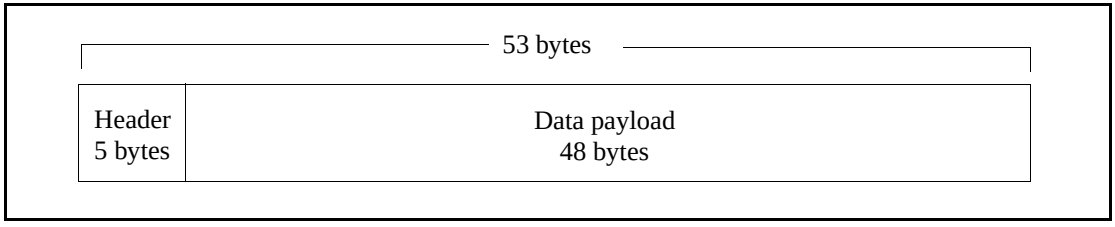

Figure 2.2 - An ATM Cell

2.2.1 ATM Adaptation Layers (AALs)

The ATM standards define various adaptation layers that convert traffic into ATM cells. Each adaptation layer is designed to segment a different type of traffic into ATM cells before it enters the ATM network. When the traffic exits the ATM network, it is reassembled into the original protocol.

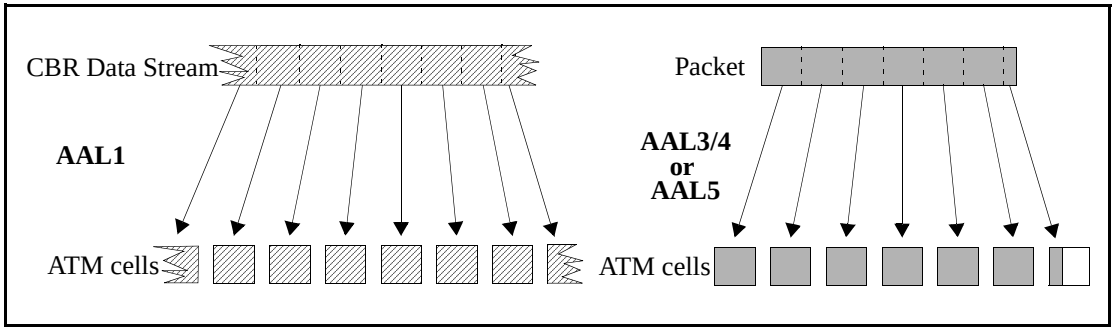

Figure 2.3 - Segmenting Traffic into ATM Cells

2.3 Virtual Connections: Paths and Channels

A link between two nodes in an ATM network can carry many channels. Channels can be bundled in paths to simplify routing. Channels and paths are referred to generically as virtual connections. A virtual connection is implemented through cells labeled with a connection identifier.

A link between two nodes in an ATM network carries a serial stream of cells. Each cell has a two-part connection identifier, called a VPI/VCI.

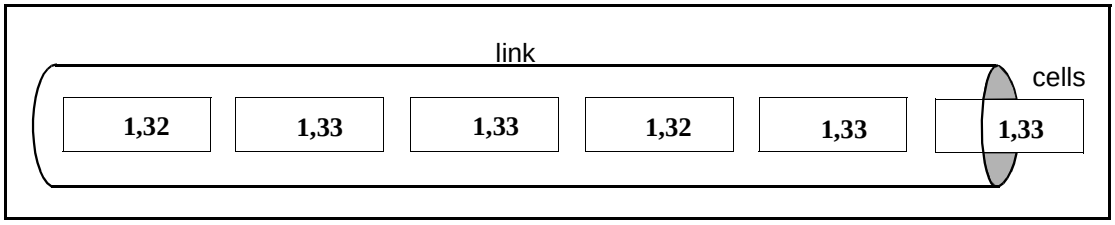

Figure 2.4 - Serial Stream of Data on a Link

The identifiers on the cell multiplex the physical link into many logical channels. Figure 2.5 shows the same link as above but depicts the cells in their virtual channels. The two channels are differentiated by the identifiers 1,32 and 1,33. All cells with the identifier 1,32 are in one channel and all cells with the identifier 1,33 are in the other channel.

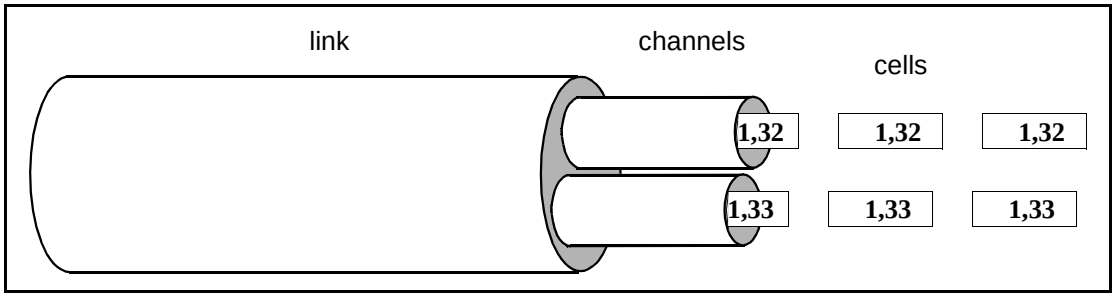

Figure 2.5 - Serial Stream Comprises Virtual Channels

2.3.1 Virtual Paths and Virtual Channels

Note that the connection identifier on a cell has two parts: a virtual path identifier (VPI) and a virtual channel identifier (VCI). The purpose of the two-part identifier is to create a simple, two-level hierarchical grouping for the connections so that channels can be “bundled” into paths.

For instance, in Figure 2.6, some of the cells have a VPI of 1 and some have a VPI of 4. All cells with the VPI of 1 are in a different virtual path than the cells with the VPI of 4.

Virtual paths make it easier to configure cross-connections. Virtual paths can switch a bundle of channels through a node all at once instead of configuring each channel individually.

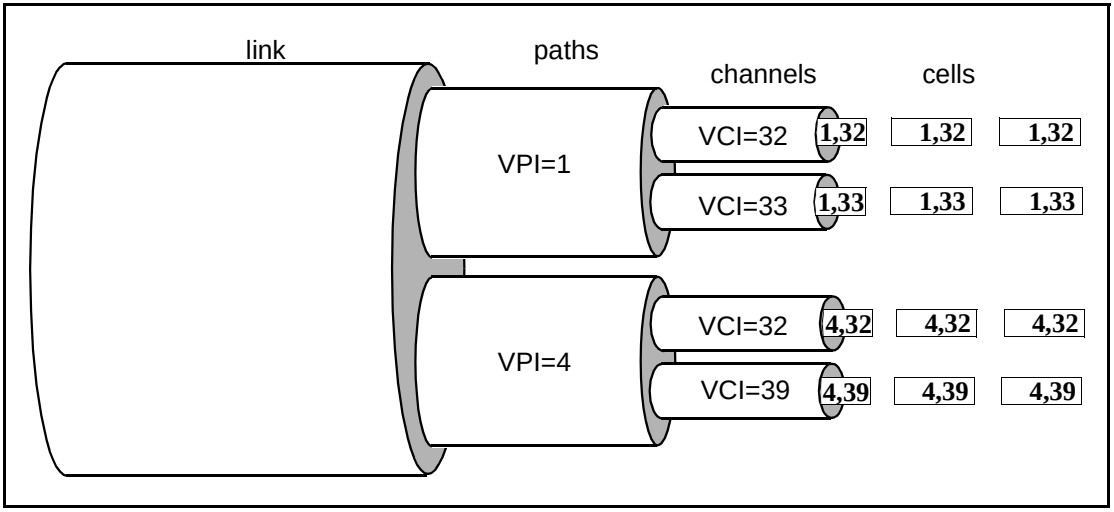

Figure 2.6 - Cells Grouped According to Path and Channel

2.4 Routing Cells

Cells in a given connection always traverse the same links to reach their destination. Cells are routed through the ATM network using mapping tables at each node along the end-to-end connection.

An ATM network routes traffic between endpoints by relaying cells at each node along the way. When a cell in a given connection arrives at a node, the node notes the port at which the cell arrives and the connection identifier on the cell. It uses this information to find an entry in a table that specifies another port and a new connection identifier. The cell is assigned the new connection identifier and is transmitted out the specified port.

Figure 2.7 illustrates how this works. It shows a connection through an ATM network with endpoints at Node A and Node D. The mapping tables at Nodes B and C switch the cell through the network to complete the connection.

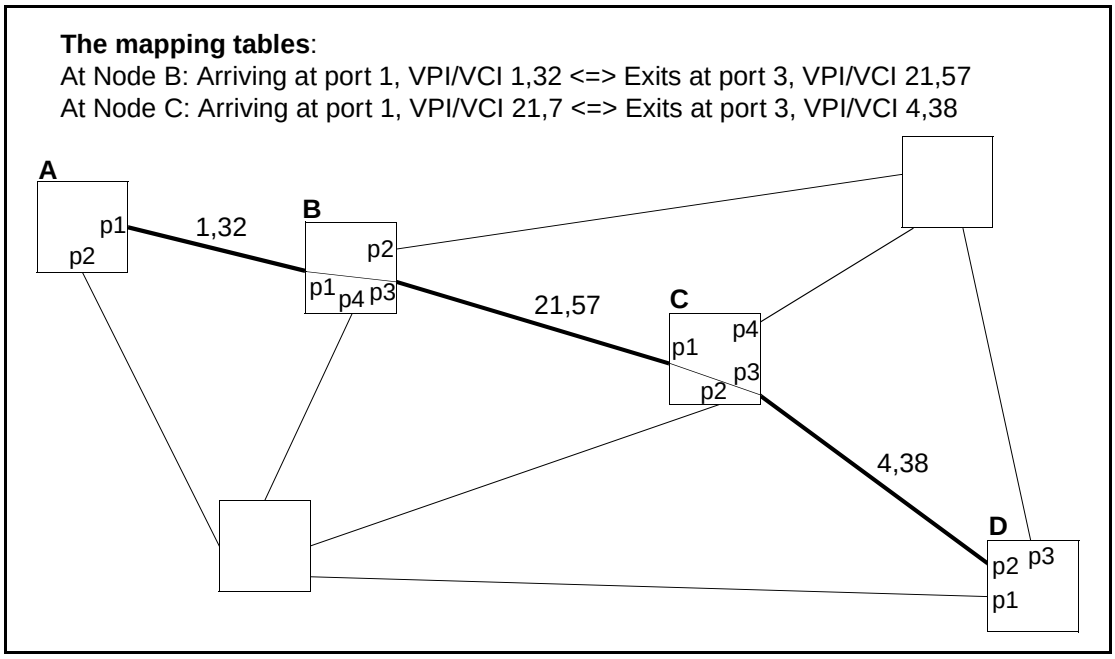

Figure 2.7 - Cross-Connections Configured Using Mapping Tables

When configuring a connection on the *CellPath* 300, a new entry in the mapping table is created that routes the connection through the *CellPath* 300. See the *CellPath 300 ATM WAN Configuration Manual* for more information.

2.5 Configuring Cross-Connections

Configuring an individual cross-connection can be time consuming. If cross-connecting many channels between two ports, virtual paths can simplify the process.

Configuring a cross-connection involves more than just mapping two VPI/VCIs to each other. Besides mapping the two connections to each other, the characteristics of the connection must also be specified. On the *CellPath* 300, these are:

- The slot and port numbers for each side of the cross-connection
- The connection identifier (VPI/VCI) for each side of the cross-connection
- Whether the connection is a path or a channel

- The traffic parameters of the connection: VBR or CBR traffic, bandwidths and priorities
- The ATM Adaptation Layer (AAL)
- In some cases, additional parameters that depend on the protocol used for the connection

2.5.1 The Benefits of Path Connections

In some cases, many channels at one link are cross-connected to another link. Configuring a connection for each channel individually can be time consuming. It is simpler to connect all the channels at once. Virtual paths enable this to be accomplished.

In order to route channels using a path connection, all the channels must have the same VPI. They should also be of the same traffic type (VBR or CBR), because the *CellPath* 300 has special buffering for each type.

When configuring a virtual path, a VCI is not specified, only a VPI for each side of the connection mapping.

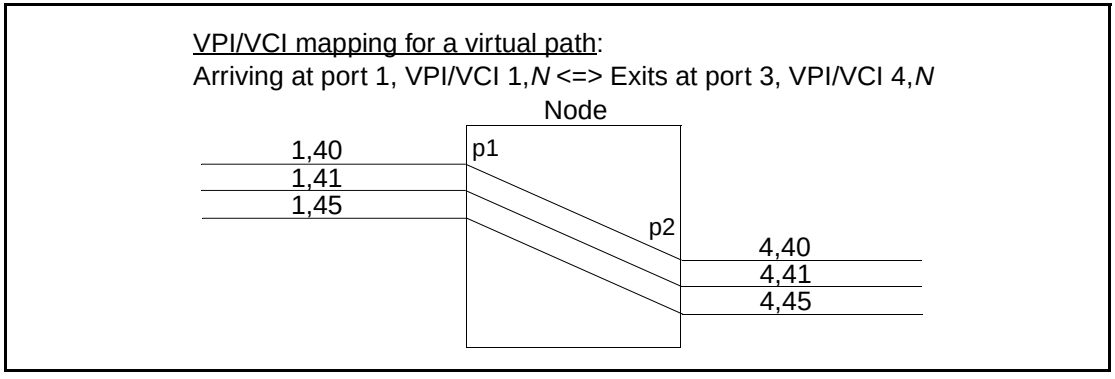

Figure 2.8 - Virtual Path Connections Pass Through the VCIs "As-Is"

Virtual paths also enable the *CellPath* 300 to support a technique called "tunneling." In this technique, two switches with the capability to set up and tear down connections through signalling use a virtual path through the *CellPath* 300 to "tunnel" the connections through. Since the *CellPath* 300 does not need to know the VCIs of the connections in the path, the two switches can change them, creating new channels and deleting old ones as needed.

2.6 ATM Bandwidth Management

With time-division multiplexing, a link is divided into separate fixed bandwidth channels. Even when there is no traffic on the channel, the bandwidth in the channel is reserved and cannot be used by other channels. With ATM, when the traffic on the whole link is low, the bandwidth is available to channels that need it.

A link between two nodes has a bandwidth defined by the physical speed of the line. A fast line passes more cells per second, and so has "wider" bandwidth. When the network administrator configures a connection, he or she distributes this bandwidth among the connections on the link. ATM takes advantage of the fact that connections on a link are not all active at the same time and so the bandwidth should be available to other connections.

This is done in the following way: when the network administrator configures a link in an ATM network, two bandwidths and a priority are assigned to the connection. These bandwidths are specified in terms of two cell rates: the peak cell rate (PCR) and the sustainable cell rate (SCR). The PCR is typically higher than the sustained SCR, though they may be equal.

As long as traffic on the link is low, the connections are allowed the configured PCR. As congestion builds on the link, the connections are reduced to the configured SCR. The connections with the lowest priorities are reduced first. If congestion continues to build, the connections with higher priorities are also reduced.

This feature is referred to variously as dynamic bandwidth, traffic management, or congestion management.

The benefits are:

- It is possible to configure connections such that the aggregate bandwidth of the connections exceeds the total bandwidth of the link.
- If there is no congestion on a link, the active connections are allowed a higher bandwidth so that the traffic on the connection can burst to a higher rate without being subject to discard.

Dynamic bandwidth management is well-suited to the bursty characteristics of VBR connections, but not for CBR traffic. CBR traffic by definition is constant; the traffic rate always consumes the same bandwidth. To support CBR traffic, configure the connection with a fixed bandwidth that is wide enough to support the traffic rate. The *CellPath* 300 further ensures the CBR traffic gets appropriate service by providing a path through the *CellPath* 300 that separates CBR from VBR traffic. Refer to the *CellPath 300 ATM WAN Configuration Manual* for more information.

CHAPTER 3 *CellPath* 300 Operation

This chapter describes how traffic is processed as it is passed through the various port types on the *CellPath* 300.

The topics include:

3.1 Cell Switching Architecture

The *CellPath* 300 utilizes a cell-based architecture. All traffic between ports is in ATM cell format and is switched through the *CellPath* 300 using ATM technology.

Table 3.1 lists the three basic port types supported by the *CellPath* 300. These designations refer to the underlying format of the protocol that the port supports.

Table 3.1 - *CellPath* 300 Port Types

Port Type	Protocol Supported
Cell Port	ATM UNI
Packet Port	Frame Relay, ATM DXI, HDLC
CBR Port	CBR

To move traffic between ports with a high degree of efficiency, all traffic the *CellPath* 300 passes between ports is in cell format (see Figure 3.1). Non-cell traffic received at a port is segmented and loaded into ATM cells. It is then put on the cell bus to be cross-connected to the transmitting port. Any traffic transmitted out of a non-cell port is handled in a converse manner and is reassembled back into the port's protocol before being transmitted.

On cell ports, the traffic is already in cell format when it is received by the *CellPath* 300, so no segmentation is necessary. Similarly, no reassembly is necessary for traffic transmitted out a cell port.

Traffic between any two ports on the *CellPath* 300 can be cross-connected if the protocols on the two ports are compatible (see Chapter 6 for a list of compatible protocols). When the *CellPath* 300 is configured to serve as a concentrator, connections from multiple ports are merged onto a single-cell port for transfer across the ATM network. However, even when the *CellPath* 300 is configured as a concentrator, individual connections can be cross-connected as needed to any other port with compatible protocols.

Only unerrored traffic is allowed onto the *CellPath* 300 cell bus. Errored traffic is discarded at the input port. Policing, rate control, and congestion management occur on the output side of the port, as explained in the following pages.

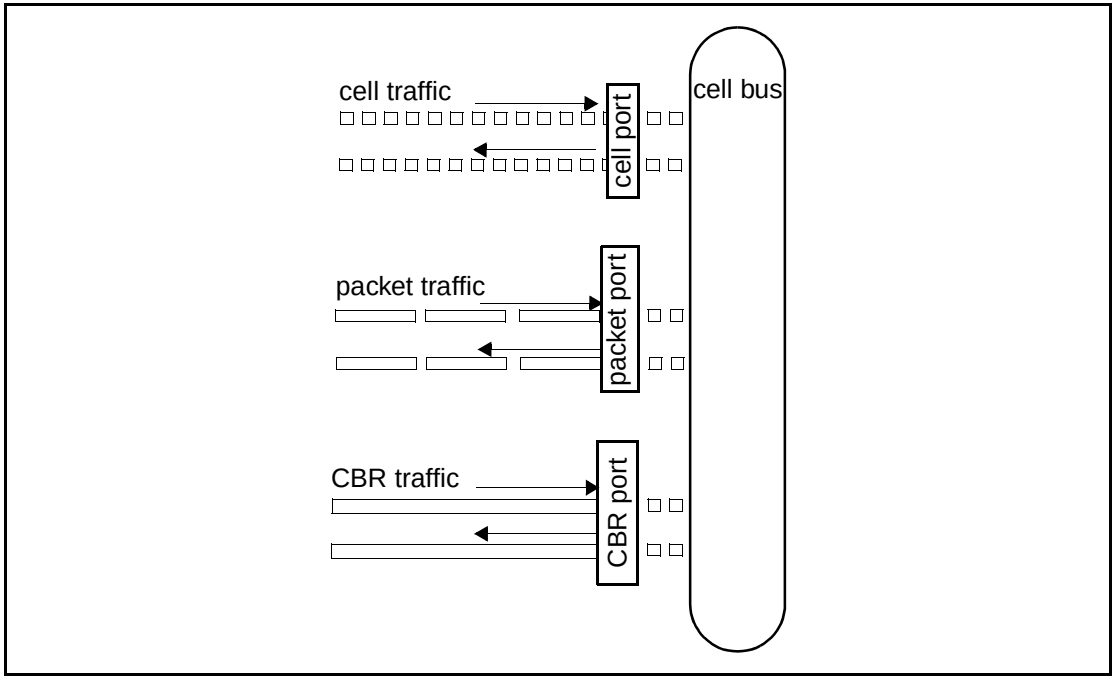

Figure 3.1 - All Traffic is Converted into ATM Cells

3.2 Packet Port Internals

A packet port services variable bit rate (VBR) traffic in packet format. The *CellPath* 300 packet port can be configured for ATM DXI, Frame Relay, and HDLC.

Packet traffic enters and exits the ATM network through a packet port. Traffic arriving at the packet port is segmented into ATM cells and introduced to the cell bus. Traffic exiting the packet port is reassembled from cells back into its original format (see Figure 3.2).

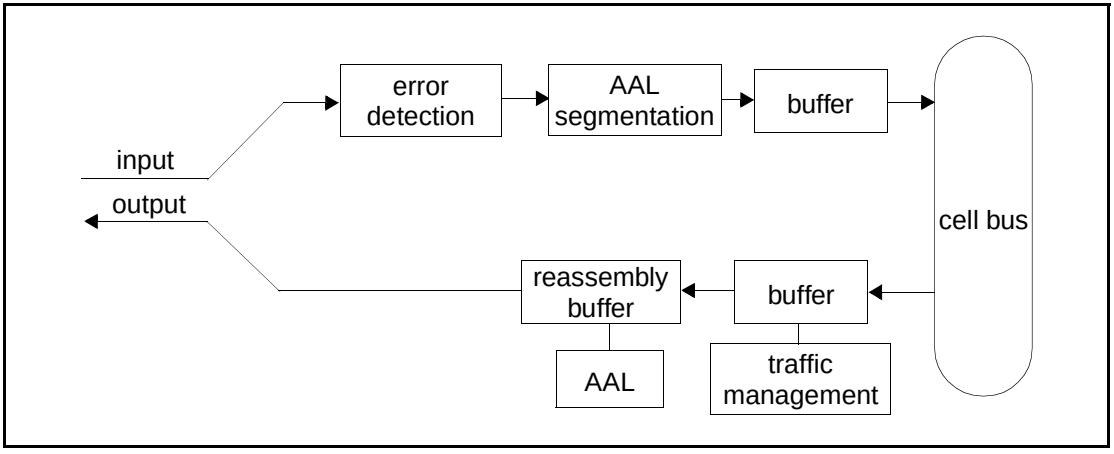

Figure 3.2 - Flow of Traffic Through a Packet Port

3.2.1 Input Path

When traffic enters the port, it is first checked for errors, such as an invalid CRC, a packet length that exceeds the maximum length, or connection identifiers that do not map to any configured connection. Any errored packets are discarded.

Valid packets are segmented into cells and put in a buffer from which they are placed on the *CellPath* 300 cell bus. The cell bus is allocated enough bandwidth such that under normal circumstances this buffer cannot overflow.

3.2.2 Output Path

Traffic exiting a packet port is at an endpoint in the ATM network, and so is converted from ATM cells back into packets. Before reassembly, the traffic is subject to traffic management. The packet port implements traffic shaping, policing, and congestion control through the traffic management function.

Congestion control refers to how the packet port dynamically changes the bandwidth of a VBR connection. Each connection is configured with three parameters: a peak cell rate (PCR), a sustainable cell rate (SCR), and a priority. The connection's bandwidth changes between the PCR and the SCR according to two factors: (1) the amount of congestion in the output path; i.e., the amount of traffic contending for entry into the output buffer, and (2) the priority of the connection.

Policing refers to the ability of an ATM device to restrict traffic to an agreed-upon rate. In some ATM devices, policing takes place on the input side, when the traffic enters the device. This is not how the *CellPath* 300 works. On the *CellPath* 300, both traffic shaping and policing are implemented on the output side. All non-errored traffic is allowed into the *CellPath* 300 and is put on the cell bus, but excess traffic is discarded before it can enter the output buffer. Traffic shaping and policing are integrated with congestion control. Bandwidth restrictions are enforced through the PCR, SCR, and priority.

Note that there are no alarms for output buffer overflow. This is because the traffic management function discards traffic when congestion occurs and so, in a certain sense, the buffer never actually overflows. However, if congestion is too severe, the discard can be so excessive that the quality of service on the connection becomes unacceptable. The rate of discard for the output buffer can be monitored using a performance monitoring report. (See the *CellPath 300 ATM WAN Multiplexer Installation and Maintenance Manual* for more information).

Traffic accepted into the traffic management buffer is next passed to the AAL function. Packets are reassembled in the AAL function, which has a buffer for that purpose. The number of packets that can be reassembled simultaneously depends on the maximum packet size specified when the packet port is configured. If the reassembly buffer is full, the cells are discarded. If a packet is errored due to a bad cell payload or a missing cell, it is discarded. Performance monitoring for the port keeps track of the number of discarded cells.

3.2.2.1 Closed Loop Flow Control

Closed Loop Flow Control enables the 10201 Packet protocol module to buffer input traffic in response to congestion at the output port. This eases the congestion at the output port and reduces packet discard within the *CellPath* 300. If the Packet protocol module is paired with a physical layer module that supports input flow control, both closed loop flow control and input flow control can be used together to reduce discard even further.

How it works: When the buffer on the output path of a cell or packet port fills to a certain point, it sends a signal to the packet port. The Packet protocol module then begins to buffer incoming traffic destined for the congested port, thus slowing the flow of traffic and lowering general congestion at the destination port (see Figure 3.3). The Packet protocol module is capable of maintaining input-path buffering for up to eight separate congested output ports.

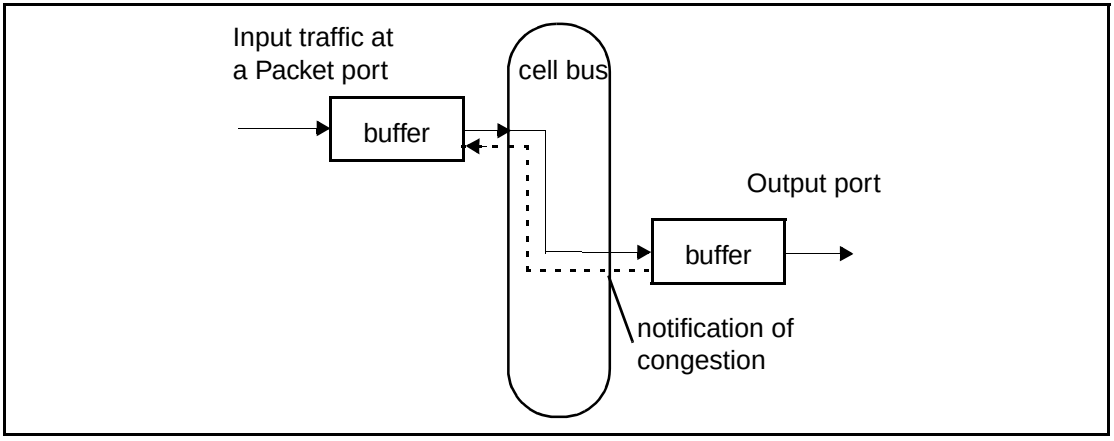

Figure 3.3 - Closed Loop Flow Control

Note that although Figure 3.3 shows only one source of traffic - the packet port to the output port - it may not be the actual cause of the congestion. The output port may have connections from other ports, and combination of which may be contributing to the congestion there. When Closed Loop Flow Control is enabled, the packet port responds to any congestion at the output port, regardless of the source of the congestion, and attempts to alleviate it by slowing the flow of its own data to that destination.

When Input Flow Control is enabled (on HSSI and V.35/EIA-530 ports) and the buffer on the input path begins to fill, the *CellPath* 300 signals the far-end device to slow the traffic to the *CellPath* 300. This prevents the input path buffer from overflowing on the *CellPath* 300.

3.3 Constant Bit Rate (CBR) Port Internals

A CBR port provides circuit emulation service for CBR traffic such as voice and video. CBR traffic enters and exits the ATM network through a CBR port. The traffic arriving at the CBR port is segmented into ATM cells and introduced to the cell bus, refer to Figure 3.4. Traffic exiting the CBR port is reassembled from cells back into a raw bit stream. This adaptation utilizes AAL1 (unstructured mode).

In unstructured mode, 47 octets of the CBR bit stream are loaded into the ATM cell payload (a one-octet SAR header is added). The CBR traffic is put into cells as is, regardless of whether the bits represent data information, physical layer framing, all zeros, or alarms. When it arrives at the endpoint of the ATM network, the traffic is converted back to the original raw bit stream. This type of transfer simulates a time-division multiplexed channel and is referred to as circuit emulation service (CES).

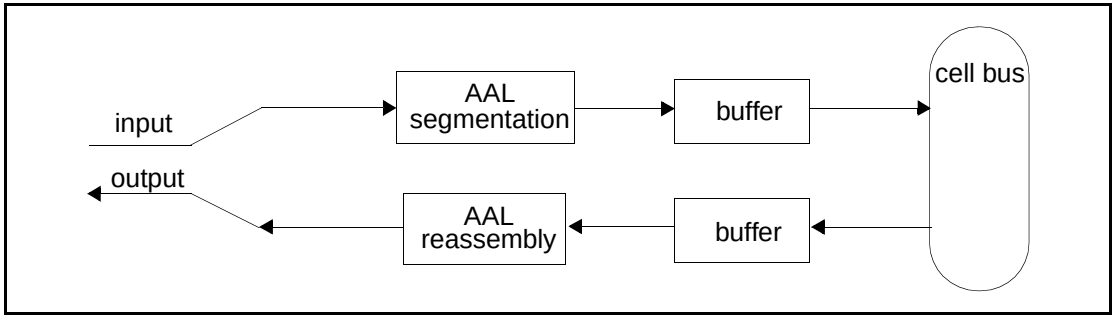

Figure 3.4 - Flow of Traffic Through a CBR Port

3.3.1 Input Path

When the CBR traffic enters the CBR port, it is segmented into cells. The segmented cells are put in a buffer from which they are placed on the *CellPath* 300 cell bus. Each CBR port is guaranteed enough bandwidth on the cell bus to service the traffic generated by the line connected to the port. The cells are loaded onto the bus without delay and are evenly scheduled to access the bus. The even scheduling helps ensure that the *CellPath* 300 does not clump CBR cells or make them too sparse. This minimizes cell-delay variation.

3.3.2 Output Path

Traffic exiting a CBR port is at an endpoint in the ATM network and so is converted from ATM cells back to a CBR bit stream.

As cells leave the cell bus, the cell header is stripped off and the cell payload is placed in the output buffer. Cell payloads are emitted from the buffer to the AAL function at the appropriate rate for the CBR connection. The AAL function checks for errors and replaces any errored payload with all ones. Then the AAL function reassembles the information into the original bit stream.

The buffer does not begin emitting cells to the AAL function until six cells have accumulated. This ensures that the CBR traffic can be re-introduced to the CBR link continuously in the presence of cell delay variation (CDV) that does not exceed the limits defined in the standard. Under normal operation the number of cells in the output buffer should remain around six.

Extreme CDV may exist, however, in outbound CBR traffic. Typically, traffic exiting the CBR port enters the *CellPath* 300 from a cell port. The CBR traffic traverses an ATM network as cells, and may have passed through any number of nodes, some of which may have introduced CDV. While the *CellPath* 300 does not introduce CDV itself, it does pass existing CDV across the cell bus to the output port.

For this reason, the output buffer at the CBR port is designed to cope with CDV. The output buffer can be configured to a maximum size of between 12 and 21 cells. If the buffer accumulates more than the maximum, an alarm is issued and cells are discarded until there is space for them in the buffer. Select a higher or lower number depending on the delay variation that is acceptable before an alarm is issued.

If the upper limit of 21 is selected, the buffer may accumulate up to 21 cells without raising an alarm or causing any skips in the continuous flow of bits into the CBR link. If a lower number is selected, the *CellPath* 300 is less tolerant of CDV and is more likely to discard traffic when it occurs.

There are two alarms associated with the output buffer: overflow and underflow. CDV could cause either alarm. If the alarm is intermittent, clearing and setting as the traffic fluctuates, it is an indication of severe CDV or clock fluctuation in the ATM network delivering the traffic.

If the alarm persists, it indicates that the connection feeding the port is set at a different rate from the port itself. In this case, service through the port would be halted.

An underflow alarm may also be caused by disruption in the traffic feeding the port.

3.4 Cell Port Internals

A cell port services ATM traffic, supporting the ATM UNI protocol and providing access to ATM networks.

A cell port provides access to the ATM network, sending and receiving both CBR and VBR traffic in cell format. The port has two different buffering systems, one for CBR traffic and another for VBR traffic (see Figure 3.5). This ensures that the CBR connections always get their configured bandwidth and are not subject to the fluctuating bandwidths associated with VBR connections. The VBR output buffer is part of the traffic management function that performs traffic shaping / policing and congestion management.

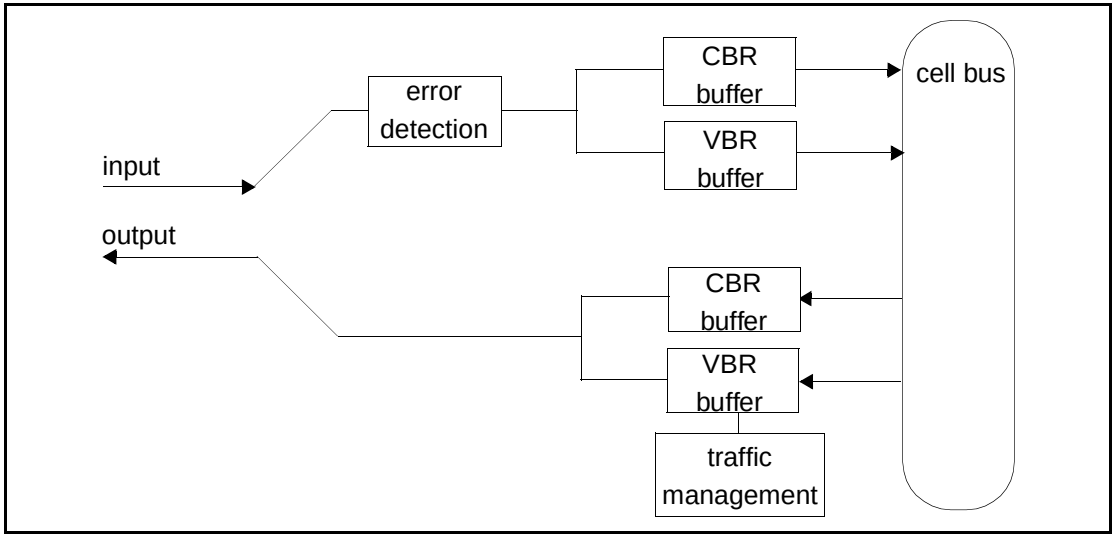

Figure 3.5 - Flow of Traffic Through a Cell Port

3.4.1 Input Path

When the cells enter the port, they are first checked for HEC violations, empty payloads, or invalid VPI/VCIs. Any errored cells are discarded.

Good cells are put into buffers for emission onto the *CellPath* 300 cell bus. CBR cells pass through a CBR buffer, and VBR cells pass through a VBR buffer. CBR cells are emitted from the CBR buffer evenly and without delay, so that the shape of the CBR traffic is maintained over the *CellPath* 300 cell bus. The CBR buffer can overflow, but only if there are misconfigured devices on the network to transmit more CBR traffic than the cell port is configured to receive. In this case, the port issues an alarm when the buffer overflows. VBR cells are emitted onto the bus in such a way that the VBR buffer should never overflow.

3.4.2 Output Path

CBR cells exiting the cell port are taken from the cell bus and put in a buffer from which they are emitted to the link connected to the port. Cells are emitted at a steady rate, without changing the shape of the CBR cell traffic. The CBR buffer can overflow if the CBR connections are incorrectly configured so that traffic from the cell bus to the cell port exceeds the bandwidth of the output link connected to the cell port. In this case, the cell port issues an alarm when the buffer overflows.

VBR cells exiting the cell port are taken from the cell bus and put in a buffer from which they are emitted to the link connected to the port. VBR cells exiting the cell port are subject to traffic management before they enter the output buffer. The cell port implements traffic shaping, policing, and congestion control through the traffic management function.

Congestion control refers to how the cell port dynamically changes the bandwidth of a VBR connection. On the cell port, configure each VBR connection with three parameters: a PCR, an SCR, and a priority. The connection's bandwidth changes between the PCR and the SCR according to two factors: (1) the amount of congestion in the VBR output path; i.e., the amount of traffic vying for entry into the output buffer, and (2) the priority of the connection.

Policing refers to the ability of an ATM device to restrict traffic to an agreed-upon rate. In some ATM devices, policing takes place on the input side, when the traffic enters the device. This is not how the *CellPath* 300 works. On the *CellPath* 300, all non-errored traffic is allowed into the *CellPath* 300 and is put on the cell bus, but excess traffic is discarded before it can enter the output buffer. Thus, both shaping and policing are implemented on the output side. Further, shaping / policing is integrated with congestion control. Bandwidth restrictions are enforced through the PCR, SCR, and priority.

Note that there are no alarms for the VBR output buffer overflow. This is because the traffic management function discards traffic when congestion occurs and so, in a certain sense, the buffer never actually overflows. However, if congestion is too severe, the discard can be so excessive that the quality of service on the connection becomes unacceptable and requires attention. The rate of discard for the output buffer can be monitored using a performance monitoring report. (See the *CellPath 300 ATM WAN Multiplexer Installation and Maintenance Manual* for more information.)

3.5 Traffic Management on the *CellPath* 300

Traffic management is a function that enforces the configured bandwidths and controls congestion through the use of early packet discard (EPD). EPD improves the efficiency of congestion control. Traffic management is applied to VBR connections on cell ports and to all connections on packet ports.

Traffic management takes place at two points: at the output buffer of a packet port and at the VBR output buffer of a cell port. Thus, all VBR connections on the *CellPath* 300 are subject to traffic management.

Traffic management determines which cells are allowed into the output buffer. Once in the output buffer, cells are emitted to the link connected to the port. In effect, traffic management determines the allowed maximum rate of output for a given connection.

Traffic management is applied to individual connections. If the connection is a channel, traffic management is applied to the channel; if it is a path, traffic management is applied to the path. By applying and enforcing traffic rates, traffic management ensures that no connection exceeds a configured bandwidth and that each connection receives a certain level of service in times of congestion.

The parameters of traffic management are PCR, SCR, and priority. The other factor is congestion, which is simply a measure of how many cells are in the output buffer. The PCR and SCR are bandwidths that are assigned to a connection when it is configured. Only one is in effect at a given time. When the traffic on the connection exceeds the bandwidth, it is subject to discard.

If there is no congestion, each connection is allowed its configured PCR. As congestion increases, connections are reduced to their configured SCR in order to reduce congestion. The connections with the lowest priority are reduced first. If congestion worsens further, the connections with the next lowest priority are reduced, and so on. If congestion becomes too severe, a more aggressive discard policy goes into effect, as described in Section 3.5.1.

Figure 3.6 illustrates these points by showing four connections with the same PCR and SCR, but with different priorities. As congestion increases, each connection is in turn reduced to the SCR.

The example is from the perspective of increased congestion. Decreased congestion affects bandwidth in an inverse manner. As congestion lessens, connections running at the SCR are increased to the PCR in an order based on the priority of the connections.

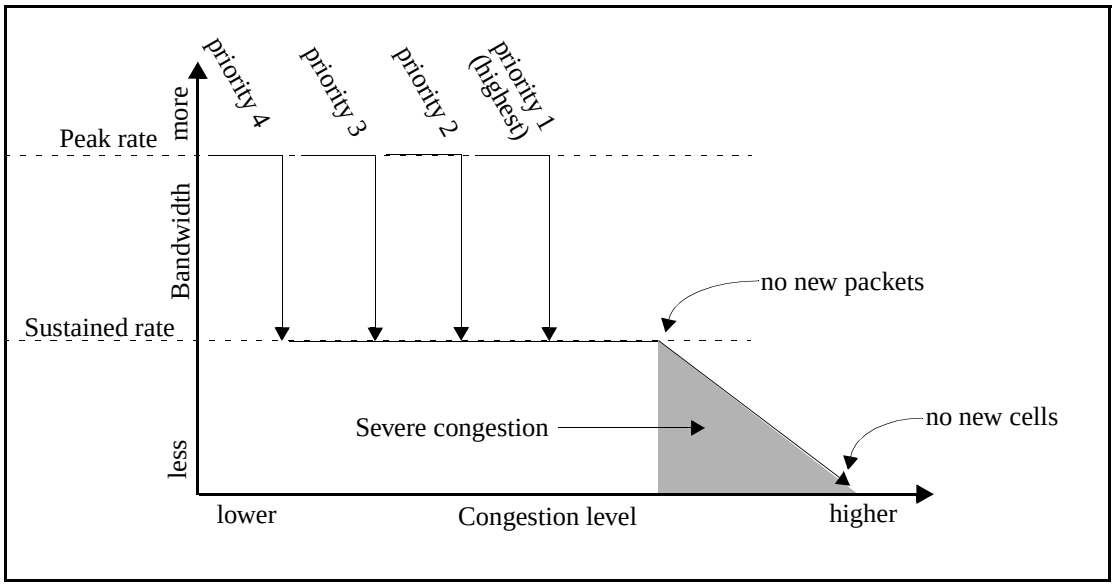

Figure 3.6 - Effect of Congestion on Bandwidth

3.5.1 Packet Level Discard

As a port becomes congested, the connections on the port are reduced to the configured SCR, and discard becomes more likely. Any time a cell from a packet is discarded, the packet is corrupted and must be retransmitted by the upper level protocol. This means the packet must traverse the ATM network again, potentially worsening the congestion that the discard was meant to abate. Since a corrupted packet must be retransmitted when the *CellPath* 300 must discard cells, it always discards all the cells in a packet.

This is referred to as packet-level discard (note that packet-level discard applies only to virtual channel connections and not to virtual path connections). There are two kinds of packet-level discard: early packet discard (EPD) and partial packet discard (PPD).

Briefly, EPD works like this. When the traffic on a channel connection exceeds the configured bandwidth, the traffic manager continues to transmit any cell that belongs to a packet that is partially transmitted. But when the first cell of a new packet arrives, that cell and all the rest of the cells in the packet are discarded. The traffic manager continues to discard packets in this manner until the average rate of the connection is lower then the connection's configured bandwidth.

3.5.2 Severe Congestion

If congestion becomes severe, the traffic manager must discard traffic more aggressively (see the shaded triangle in Figure 3.6). At the start of severe congestion, the traffic manager begins discarding packets arriving from any connection, regardless of whether or not the traffic on the connection is exceeding its bandwidth. As before, only complete packets are discarded. This policy stays in effect until either the severe congestion clears or it worsens to the point where the buffer is full. At that point, the traffic manager begins discarding all new cells that arrive at the port, even cells that belong to packets that are already partially transmitted. However, once the traffic manager begins discarding a packet's cells, it discards all remaining cells in the packet, even if the severe congestion clears in the meantime. This feature is referred to as PPD.

In general, neither of these conditions is desirable if it persists. The first situation is undesirable because connections are submitted to traffic discard even though they have not violated the configured bandwidths. The second condition has the same problem, with the additional problem that it is allowing the transmission of partial packets and so the discard is not as efficient in relieving congestion. In general, severe congestion is a sign that the port is over-subscribed and the number of channels should be reduced or their configured bandwidth should be reduced.

3.6 Frame Relay Link Management on the *CellPath* 300

Frame Relay Link Management allows the monitoring of the status of a physical link and the status of the virtual connections on that physical link.

Any packet port on the *CellPath* 300 configured for Frame Relay UNI can be set up to use Frame Relay Link Management (FRLM) procedures. Each Frame Relay port can be configured as either a user device or a network device - or it can be configured as both a user device and a network device to operate bidirectionally.

When a device is configured as a user device, it polls the connected device(s) for information about the status of the link and its virtual connections. When a device is configured as a network device, it is able to respond to such requests with relevant status information.

A network-to-network link is created when both devices are configured to operate bidirectionally. Both devices act the dual roles of the user and the network. The two devices are able to compare their lists of active and existing PVCs, and to pass any inactive PVC status learned to neighboring network or user devices.

3.6.1 Status Requests and Responses

Link Integrity Verification (LIV) provides status information about the link. Full Status includes information about the link, and information about the virtual connections, specifically whether each PVC is active or inactive, and whether each PVC is new (created since the last Full Status response was sent).

STATUS INQUIRY messages are requests for information that includes both Link Integrity Verification (LIV) requests and Full Status requests.

STATUS messages are responses to queries and include LIV responses and Full Status responses.

3.6.2 Message Formatting

Specifications developed by various standards bodies determine the formatting of these messages. These formats are:

- ITU-T Q.933 Annex A
- ANSI T1.617a-1994 Annex D

3.6.3 Application Examples

The Frame Relay Link Management procedures allow information about active and inactive Frame Relay PVC status to propagate over the corresponding ATM PVC through the ATM network. The PVC status information is mapped to OAM fault management cells.

In the example shown in Figure 3.7, all *CellPath* 300 systems are interworking between a number of Frame Relay routers and the ATM network which interconnects them.

Each *CellPath* 300 is configured as a network device and each router is configured as a user device. OAM Fault Management cells are sent on inactive ATM PVCs between the various *CellPath* 300 systems to provide end-to-end active/inactive status of the Frame Relay PVCs terminating at each Frame Relay router.

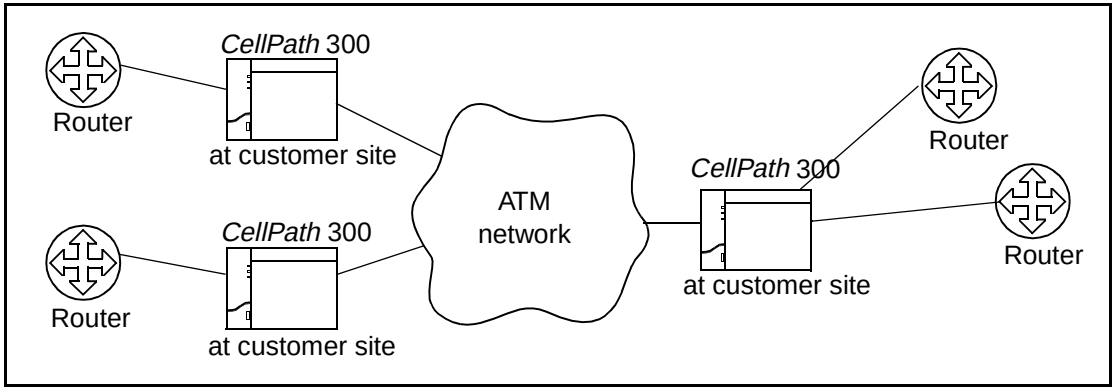

Figure 3.7 - Interworking Between Frame Relay DTE and ATM Network

In Figure 3.8, a single *CellPath* 300 is interworking between an ATM network and a Frame Relay network.

The *CellPath* 300 is configured as both a network device and a user device. The *CellPath* 300 uses OAM Fault Management cells to pass active/inactive status over the ATM PVCs, and performs bidirectional FRLM operations with its neighboring Frame Relay switch(es) to pass active/inactive status over the Frame Relay PVCs.

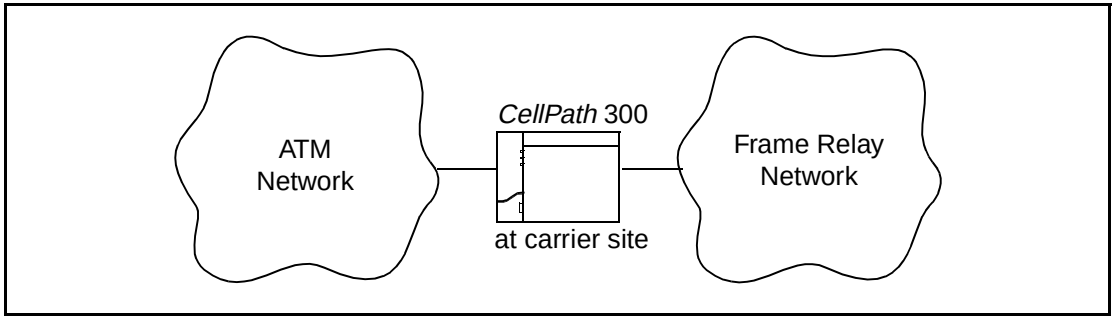

Figure 3.8 - Interworking Between Frame Relay and ATM Networks

In Figure 3.9, a single *CellPath* 300 is acting as a Frame Relay switch, with ATM-oriented cross connections over the internal cell bus between the various Frame Relay UNI VBR/Packet ports.

The *CellPath* 300 performs bidirectional FRLM operations with its neighboring Frame Relay switches to pass active/inactive status over the Frame Relay PVCs. On links to Frame Relay routers, it performs FRLM operations as a network device only. The routers are configured as user devices.

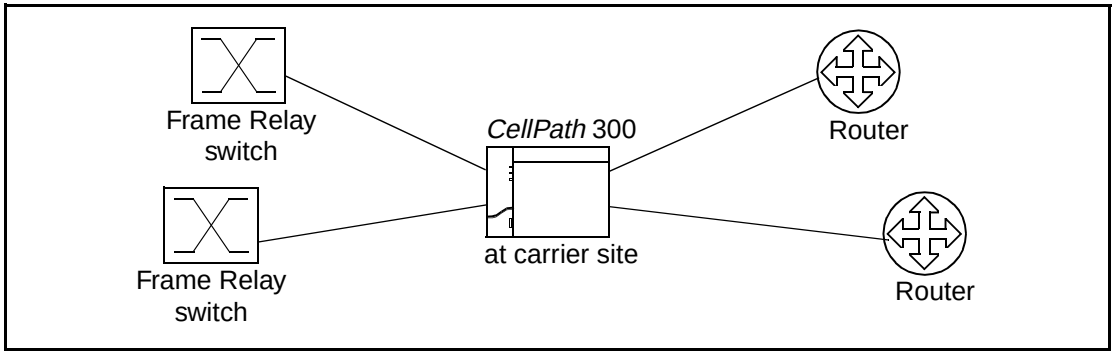

Figure 3.9 - *CellPath* 300 as a Frame Relay Switch

3.6.4 How OAM Cells Notify of A Failure

OAM cells on the *CellPath* 300 carry operations and maintenance information, not user data, over a virtual connection. AIS F5 OAM and RDI F5 OAM cells are OAM fault management cells that operate at the ATM layer and provide end-to-end status information during failure conditions. F5 OAM cells are passed on the same virtual channel as user data.

OAM fault management cells are generated at a Frame Relay UNI port and then are passed out a cell port onto the ATM PVC. This capability can be enabled for some ports and disabled for others. The settings for each cell port determine whether OAM cells are actually transmitted by the *CellPath* 300.

NOTE

The *CellPath* 300 always has the ability to receive OAM fault management cells that are generated by another device upstream. The Frame Relay UNI port is the ATM PVC endpoint for these OAM cells.

Frame Relay Link Management uses AIS and RDI OAM cells to propagate notification of failures across the ATM network. Failures of links or connections occurring at a particular endpoint or in the middle of the network can be communicated to the remote terminal equipment at each end. This allows routers to accurately determine which PVCs are functioning and which are not, allowing it to make better routing decisions and recover from failures more rapidly.

Alarm Indication Signal (AIS) cells are generated for such service-affecting conditions as LOS, LOF, RAI, or when the *CellPath* 300 PM / PLM is declared out of service, alerting the end-point that a failure was detected upstream. When the *CellPath* 300 receives AIS cells, it returns Remote Defect Indication (RDI) cells to notify the upstream ATM devices that the PVC is down.

Figure 3.10 shows a link breakage that affects only one direction of ATM cell transmission.

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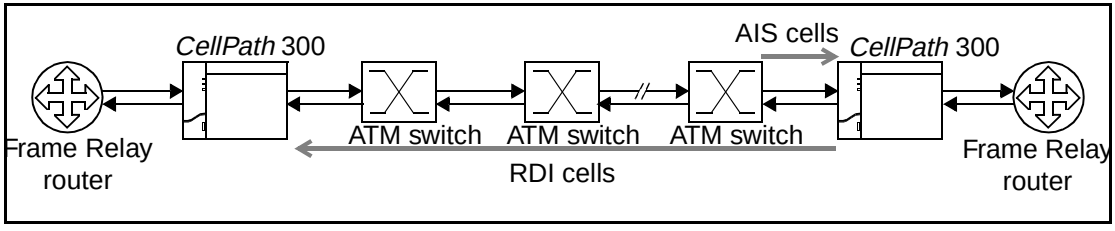

Figure 3.10 - OAM Cell Action When A Break Occurs in One Direction

Figure 3.11 shows a link breakage that affects ATM cell transmission bidirectionally.

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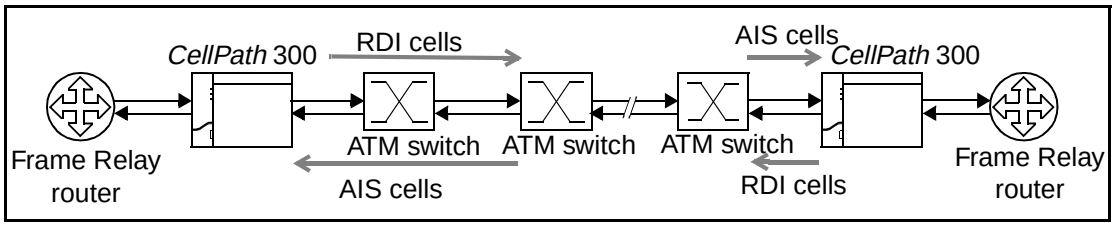

Figure 3.11 - OAM Action When A Break Occurs in Both Directions

AIS F5 OAM cells are generated towards the remote end on PVCs terminating on a packet port when:

- The packet port is experiencing a service affecting condition (LOS, LOF, RAI, or PM / PLM is declared out of service).
- The packet port learns through Frame Relay Link Management messages from a terminal device or frame relay switch that a PVC has become inactive.

AIS F5 OAM cells are received on a PVC terminating on a packet port when:

- A failure occurs in the remote device or *CellPath* 300 that causes AIS cells to be generated by the remote device or *CellPath* 300.
- A failure occurs in the middle of an ATM network, causing an ATM switch or Frame Relay to ATM Interworking node to transmit AIS cells.

RDI F5 OAM cells are generated on a PVC emanating from a packet port whenever AIS F5 OAM cells are received by the packet port on that same PVC.

RDI F5 OAM cells are received by a packet port on a PVC when a failure occurs in the egress path of the PVC between the packet port and the remote packet port to indicate that the remote device is not receiving the data being generated.

3.7 Inverse Multiplexing Over ATM (IMA)

This feature provides a method of combining the bandwidth of multiple T1 or E1 links that are grouped to provide higher intermediate rates.

Inverse multiplexing provides access and connection services to high speed ATM streams using multiple T1 or E1 links. Inverse multiplexing is used because:

- More bandwidth than T1 or E1, but less than T3 or E3, needed.
- The cost of four T1 or E1 lines is much lower than a single T3 or E3 line.
- DS3 and E3 links are not always available throughout a network.

An IMA physical layer module represents one port with multiple links. On the IMA module, a port is referred to as a Group and is comprised of up to four links.

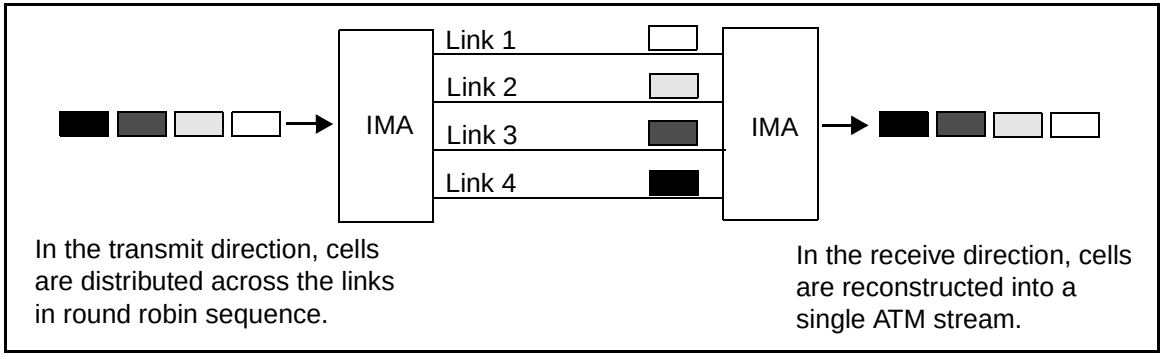

Figure 3.12 - Four Links Become One Logical Link

3.7.1 Automatic link adjustment

Automatic link adjustment enables traffic to be redistributed, with minimal disruption, when a link is added or dropped. The IMA protocol always determines the number of available links and uses as many as are available. All links must be set to Enabled at start up.

A link may be dropped due to a degradation in quality, when Link Control Protocol (LCP) cells are not received in the specified interval (or are received with an unexpected ID), or because a link is exhibiting excessive differential delay.

If an application has a required minimum bandwidth, the minimum number of links to support certain traffic requirements may need to be specified. This is done by setting the number of redundant links—the number of links that can be lost and still meet bandwidth needs.

3.7.2 Control Protocol Cells

OAM cells carrying control information are interspersed with data at regular intervals in the IMA cell streams. These OAM cells function on segments of the traffic's path.

3.7.2.1 ACP Cells

ATM Inverse Multiplexer (AIMUX) Control Protocol (ACP) cells are OAM cells that contain group level information. ACP cells set up and configure the multiple links as an ordered set (group), arbitrate for a group ID in order to synchronize the streams between two AIMUX units, and monitor changes to the group status. A reserved VPI/VCI value of 0,34 is used for ACP cells.

3.7.2.2 LCP Cells

Link Control Protocol (LCP) cells are used to determine the link integrity and relative delays between the links of a group. For each link, one LCP per frame (once every 128 cells for T1 and E1) is sent in the egress direction (exiting the *CellPath* 300). In the ingress direction (entering the *CellPath* 300), LCPs are monitored to update the status for each link.

LCP cells enable computation and adjustment for differential link delays, facilitate the addition or deletion of a link, and identify the source node of the LCP. A reserved VPI/VCI value of 0,33 is used for LCP cells. In addition, 0,35 is reserved for filter cells which are used in lieu of idle cells.

3.7.3 Delay Compensation Buffer

The delay compensation buffer enables received cells to be delayed until all four streams are ready to go. Because each stream may take a different route through the network, the rates on each physical line may differ slightly. The delay differential is the difference in time it takes a cell to traverse the network between the fastest and the slowest links. The buffer uses the information contained in the LCP cells to adjust for this difference.

A link is considered to be in Link Delay Synchronization (LDS) if there are no current physical alarms and the differential delay is within the acceptable range.

CHAPTER 4 Login Procedure

This chapter describes how to log in and out of the *CellPath* 300, and covers the following topics:

- Access privileges
- Logging in
- Logging out

4.1 Logging In and Out of the *CellPath* 300

Whether accessing the *CellPath* 300 through a Telnet session or through a terminal connected to the communications port, the login procedure is the same, enter a password, followed by the terminal type.

The *CellPath* 300 has three levels of access. The login password grants one of these three levels of access:

super user Grants SUPER USER access. Users with SUPER USER access can change configuration parameters, set passwords and issue SNMP community strings. Enter `su` to be granted super user access.

read/write Grants READ / WRITE access. Users with READ / WRITE access can change configuration parameters, but cannot view or set passwords or issue SNMP community strings. Enter `rw` to be granted read / write access.

read only Grants READ ONLY access. Users with READ ONLY access cannot view or set passwords or issue SNMP community strings. All other screens can be opened in read-only mode. Enter `ro` to be granted read only access.

See the *CellPath 300 ATM WAN Multiplexer Configuration Manual* for more information.

Prior to logging in, the *CellPath* 300 displays the following:

```
--- Welcome to the CellPath 300 ! ---
Please enter your password:
```

After entering the password, the following displays. Enter a number, `0` through `2`, to specify the terminal being used, or `Q` to quit.

```
SU access granted
Your system default terminal type is = 'vt100'
Enter the number for your terminal type
IMPORTANT - choose correctly!!
       <0> [ default ]
       <1> vt100
       <2> Sun shelltool (OpenWindows)
       <Q> quit
```

If option 1 is selected, be sure to refer to the *CellPath 300 ATM WAN Multiplexer Installation and Maintenance Manual* for important information on terminal settings.

If the incorrect terminal type is entered, the display may contain illegible characters. In this case, press the `<Esc>` key twice to return to the preceding screen and try again.

If accessing the *CellPath* 300 via Telnet and the incorrect terminal type is selected, wait 30 seconds and the *CellPath* 300 logs out of the Telnet session.

If the correct terminal type is entered, the `System Configuration` (Figure 4.1) screen opens, from which all other screens in the user interface can be accessed.

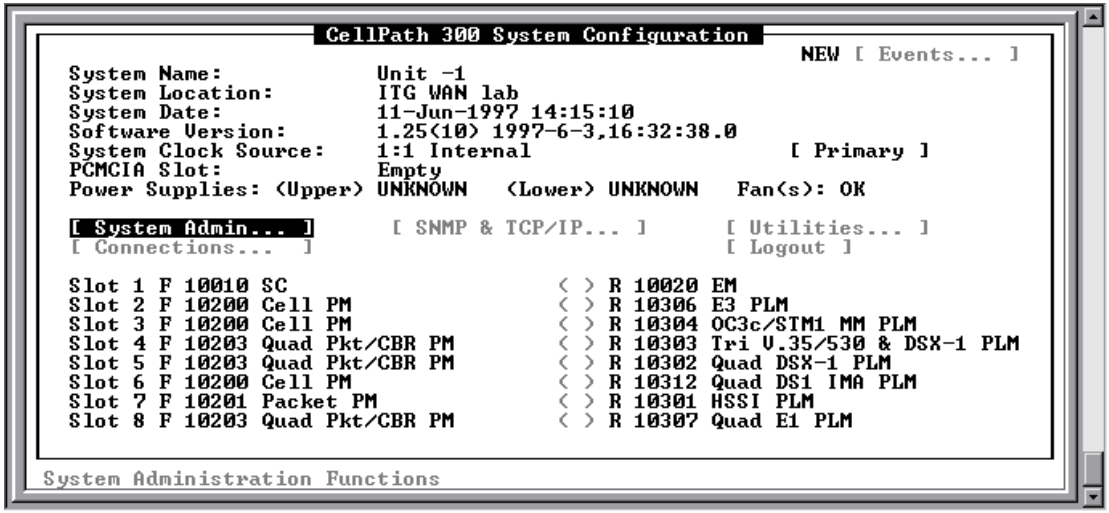

Figure 4.1 - *CellPath* 300 System Configuration Screen

4.1.1 Simultaneous Logins

Up to two users may be simultaneously logged into the internal user interface. The comm port always uses one of these logins, even when no terminal is connected or when a connected terminal is only displaying the login prompt. The remaining login session is available through either an Ethernet connection or an in-band connection.

Besides these two logins, users may also simultaneously access the *CellPath* 300 remotely through an SNMP-based management system.

The *CellPath* 300 system software does not guarantee system integrity when multiple users access the *CellPath* 300 simultaneously. This is not a problem if precautions are taken to prevent multiple users from simultaneously modifying the system configuration.

It is the responsibility of the system administrator to prevent different users from making conflicting changes to the system configuration simultaneously. This can be done through careful use of passwords or by managing system use.

4.2 Logging Out of a Session

To log out of the *CellPath* 300, use the `[Logout]` button on the `System Configuration` screen. This only closes out this active session; it does not affect other active sessions.

4.2.1 Automatic Logout

The *CellPath* 300 has an automatic logout feature. If a session has been idle (no keystrokes) for 30 minutes, that session is automatically logged out.

CHAPTER 5 User Interface

This chapter describes the user interface to the *CellPath* 300, which is implemented as ASCII text-based screens arranged in a hierarchy. The *CellPath* 300 `System Configuration` screen, which is at the root of the hierarchy, appears when the user first logs in. From the `System Configuration` screen, other screens are available and traverse the entire hierarchy.

This chapter covers the following topics:

- The user interface hierarchy of screens
- User interface conventions

5.1 The User Interface Hierarchy

The *CellPath* 300 user interface is a hierarchy of screens, with the *CellPath* 300 `System Configuration` screen at its root. The hierarchy can be roughly divided into two types of screens, as shown in Figure 5.1: screens for system-based functions and screens for port-based functions.

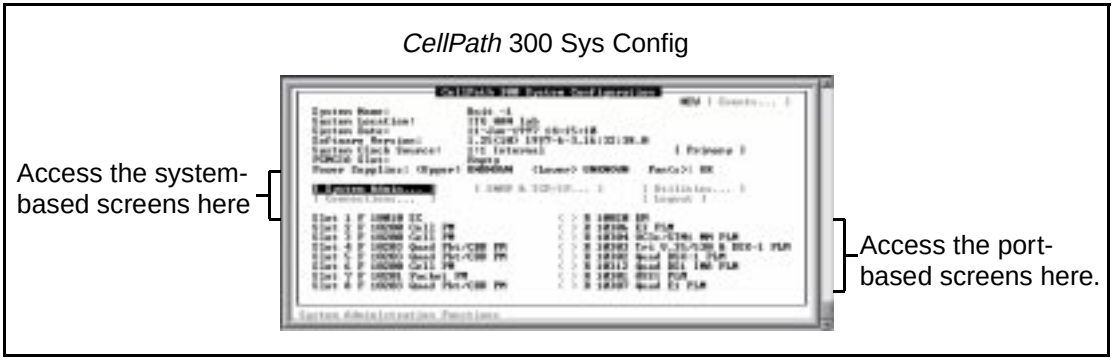

Figure 5.1 - *CellPath* 300 System Configuration Screen Layout‘

5.1.1 Screens for System-based Functions

System-based screens include: the `System Administration` screen, the `SNMP/TCP/IP Management` screen, the `Connections` screen, and a `Utilities Selection` screen, refer to Figure 5.2.

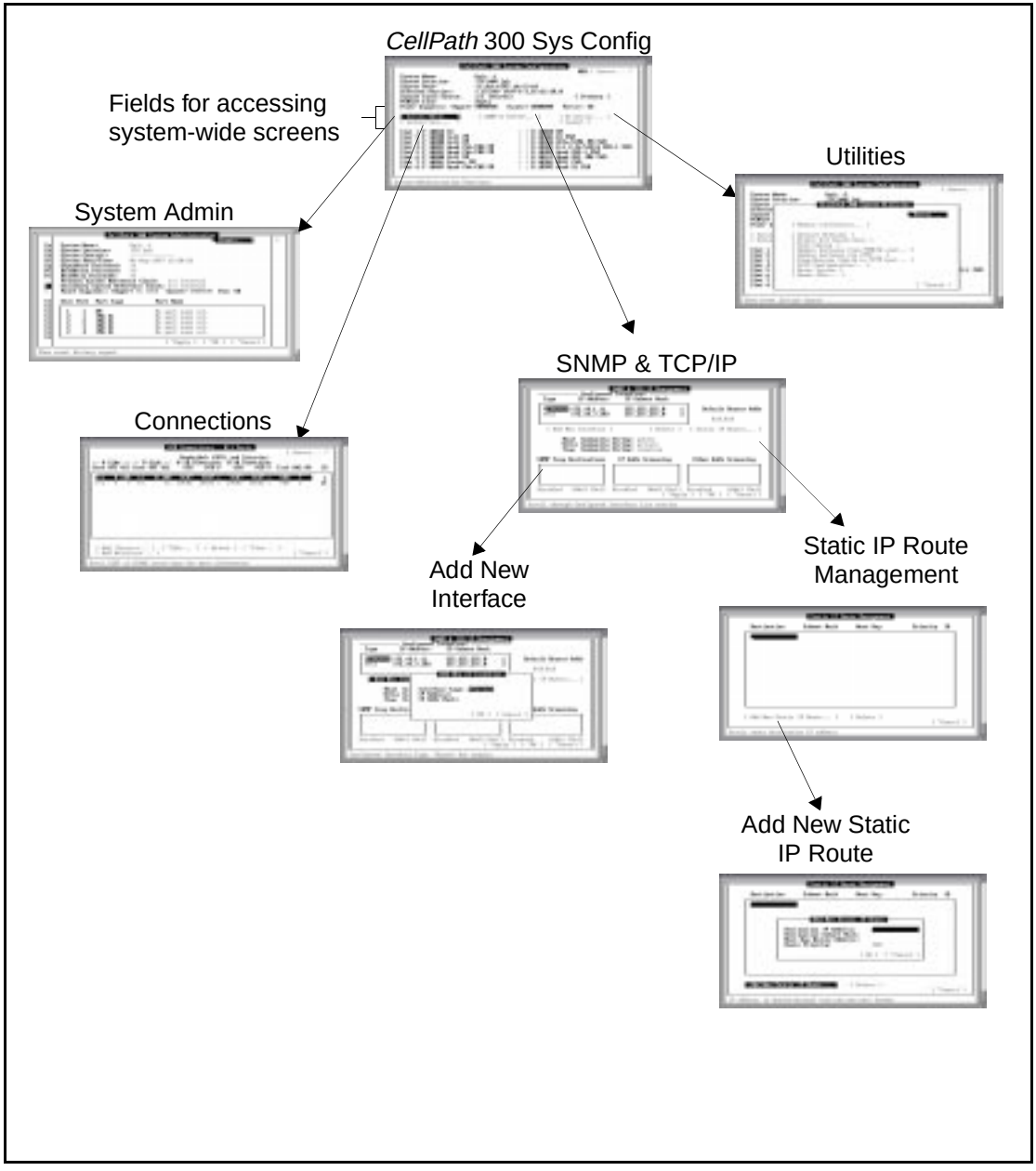

Figure 5.2 - Hierarchy of the *CellPath* 300's System-based Screens

5.1.2 Screens for Port-based Functions

- Port-specific screens include: the `Port Configuration` screens, `Statistics` screens for the physical layers, `Statistics` screens for the protocol layers, a `Connections` screen for each port, and various screens for adding and editing connections.
- The `System Configuration` screen has a field for each slot on the *CellPath* 300 that can hold a module combination. Select the slot to access the port-based screens.
- Though the screens are basically the same for single-port modules and quad-port modules, the access hierarchy differs. (See Figure 5.3 and Figure 5.4).

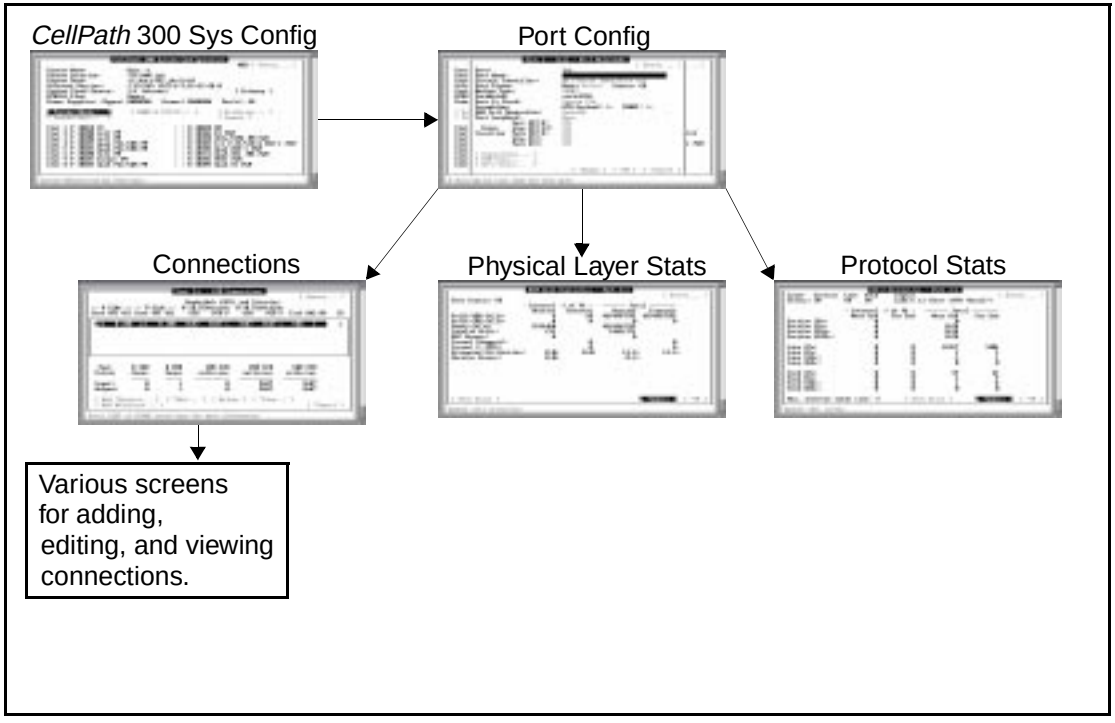

Figure 5.3 - Hierarchy of Port-based Screens for a Single-port Module

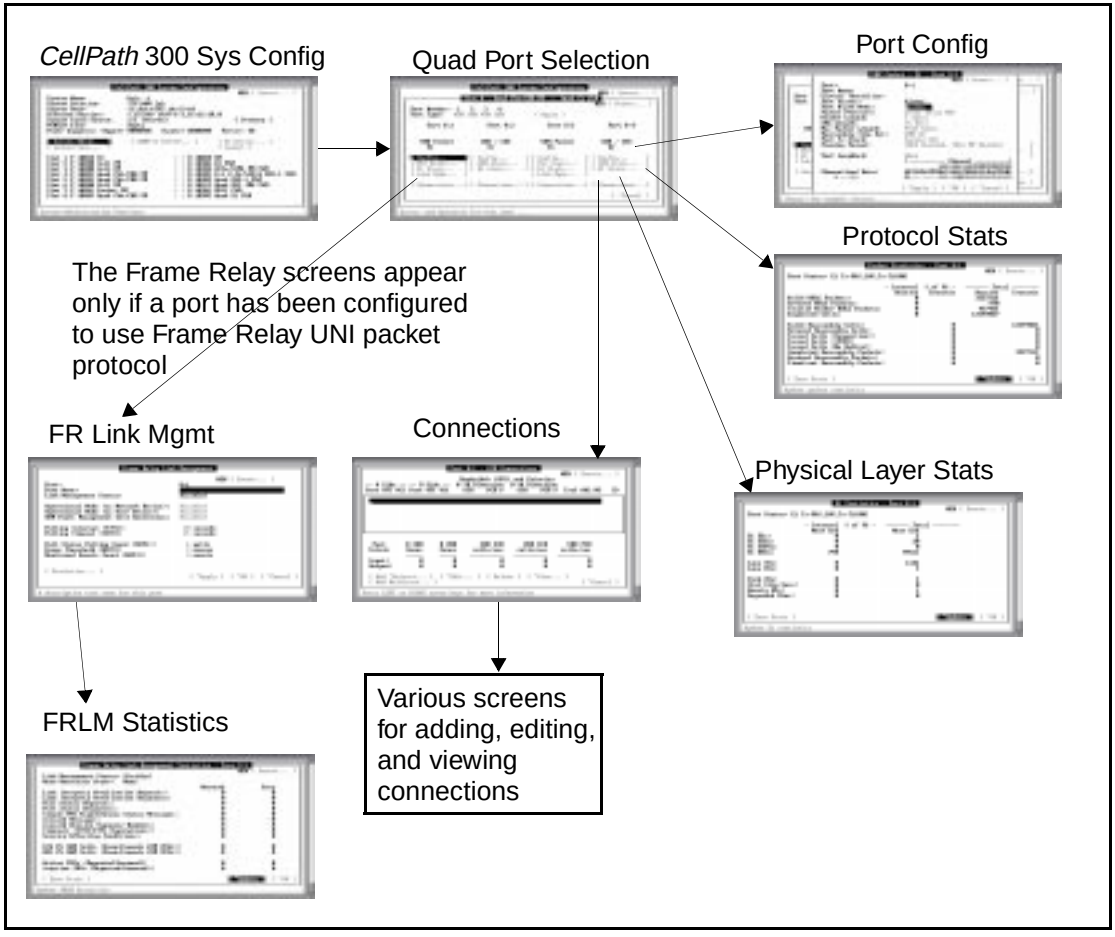

Figure 5.4 - Hierarchy of Port-based Screens for a Quad-port Module

5.1.3 IMA-based Functions

The IMA screens and reports shown in Figure 5.5 appear when an IMA DS1/E1 PLM is installed.

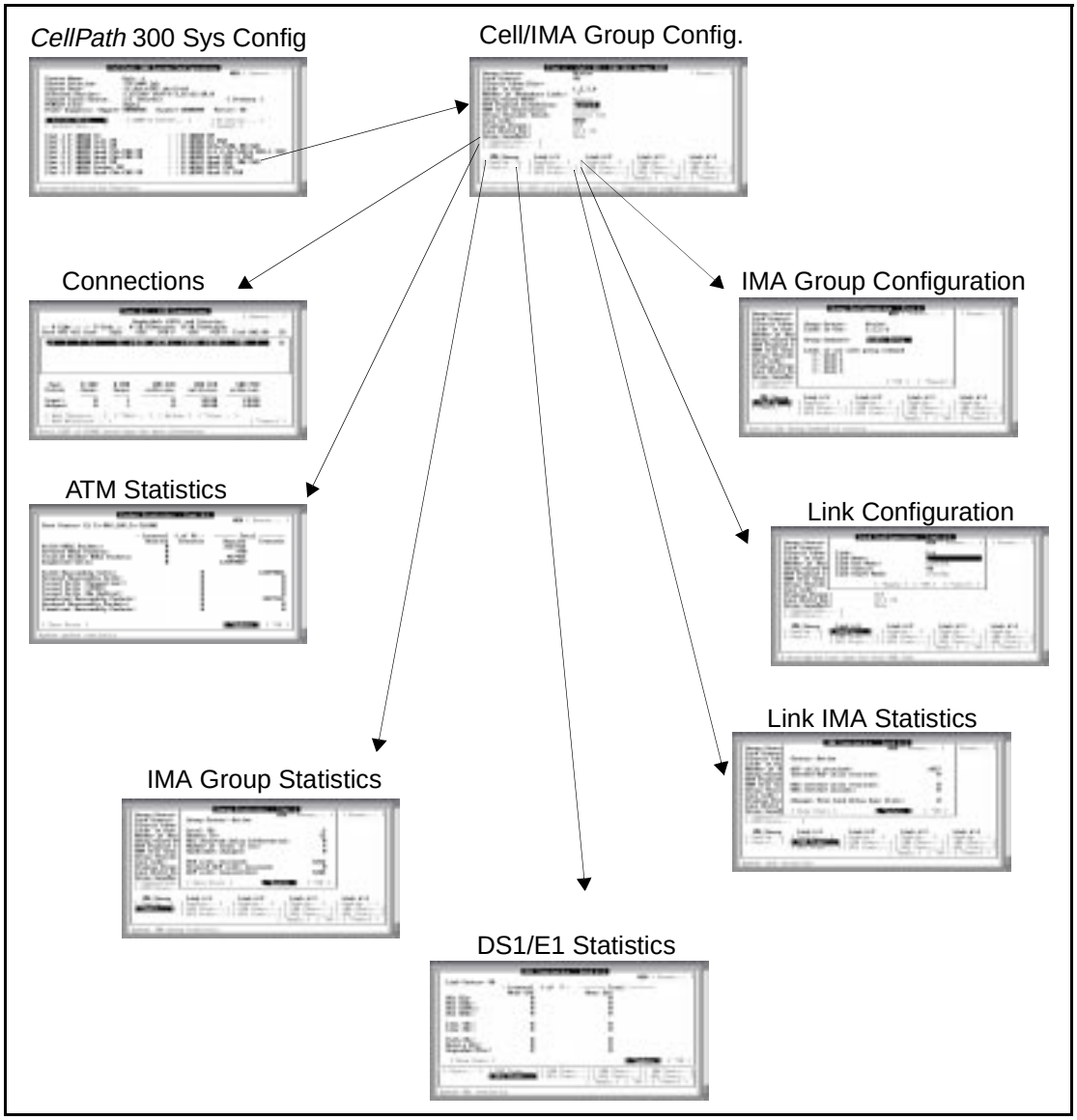

Figure 5.5 - Accessing the IMA Screens

5.2 User Interface Conventions

CellPath 300 screens consist of fields, buttons, and a cursor. Fields provide *CellPath* 300 status information and allow various system parameters to be set. Buttons perform actions such as dismissing screens or opening other screens. The cursor is a highlighted field or button.

5.2.1 Fields

Screens in the user interface feature several kinds of fields. Each of the various field types are described in the following paragraphs.

5.2.1.1 Read-Only Fields

Read-only fields provide information about parameter values, but do not allow the editing of the data in the fields. The cursor does not move into read-only fields. Note that some fields that are read-only on one screen may be editable on another.

5.2.1.2 Editable Fields

Editable fields allow test to be entered directly. When the cursor is moved to an editable field, a prompt appears at the bottom of the screen indicating what kind of values should be entered. Typically, alphabetic or numeric characters can be used, as well as the `[backspace]`, when editing these fields.

5.2.1.3 Toggle Choice Fields

Toggle Choice fields allow choices from two or more values by pressing the space bar. When the cursor is moved to a Toggle Choice field, the message “Spacebar scrolls through choices” appears at the bottom of the screen. Press the space bar until the desired value appears in the field.

5.2.1.4 Choice List Fields

Choice List fields allow selections to be made from the displayed list of choices. Some choice lists appear as soon as the cursor is moved onto the field. For others, the `<F2>` key or `<Ctrl-P>` must be pressed to pop up a list. Once the list is visible, the user can scroll through the choices using the up and down arrows, then press `<ENTER>` to select the choice.

5.2.1.5 Scrollable Regions

Scrollable regions are groups of fields that modify the normal working of the cursor movement keys. They are denoted by a box surrounding a list of related fields. To access a scrollable region, use the cursor movement keys in the normal manner. Once the cursor is inside the

scrollable region, the arrow keys or the <ENTER> key moves the cursor between fields inside the scrollable region, while the <Tab> or <Shift-Tab> keys move from the selected field in the scrollable region to a field outside the scrollable region.

NOTE

To save screen edits, be sure to select the [^Apply] button or the [^OK] button before opening another screen. If edits are made to a screen, and then a second screen is opened on top of the first screen without selecting [^Apply] or [^OK] - when the second screen is dismissed, the first screen no longer contains the original edits.

5.2.2 Buttons

On *CellPath* 300 screens, buttons are denoted by text enclosed in square brackets ([ ]). Buttons come in two varieties in the user interface: action buttons and screen access buttons.

5.2.2.1 Action Buttons

Action buttons cause an action to be performed immediately. Select an action by moving the cursor to an action button and pressing the <ENTER> key. Certain action buttons are available only to users with appropriate access permissions. The most common action buttons are as follows:

[^Apply] Apply changes made in the screen without exiting. The keyboard equivalent is <Ctrl-A>.

[^OK] Apply changes made in the screen, then exit (i.e., return to the previous screen). The keyboard equivalent is <Ctrl-O>.

[^Cancel] Exit without applying changes made in the screen. The keyboard equivalent is <Ctrl-C>.

[Zero Stats] This button appears on port statistics screens and causes all statistical counters on that screen to be set to zero, including all interval counts and totals associated with the port.

5.2.2.2 Screen Access Buttons

Screen access buttons display new screens. These buttons are denoted by an ellipsis (. . .) appearing within the square brackets after the name of the screen to be displayed. To bring up a new screen, move the cursor to a screen access button and press the <ENTER> key.

5.2.3 Other Interface Options

If VT100 emulation is being used, the function keys and <Shift-Tab> may not be correctly mapped and may not work as described. (When using VT220, VT320 or VT420 terminals, set up the terminal to emulate a VT100.) Table 5.1 shows the correct mapping.

Table 5.1 - VT100 Keyboard Mapping

Key	Decimal Mapping	HEX Mapping	Key Mapping
F2	027 079 081	1B 4F 51	Esc O Q (O, not zero)
F7	027 079 113	1B 4F 71	Esc O q (O, not zero)
F8	027 079 114	1B 4F 72	Esc O r (O, not zero)
Shift-Tab	027 098	1B 62	Esc b

Use the <F2> (or <PF2>) key to display a pop-up Choice List available for some fields.

If a mouse is connected with the terminal emulation program, do not use it with the native *CellPath* 300 user interface. The interface does not support a mouse.

CHAPTER 6 Configuring Ports

This chapter steps through the minimum configuration steps needed to set up the *CellPath* 300 interface ports. Read the first three sections of this chapter, then turn to the port configuration sections that match the system application.

This chapter does not explain how to set up ATM connections. Refer to the *CellPath 300 ATM WAN Multiplexer Configuration Manual* for procedures on setting up connections and remote access.

6.1 Overview of the Configuration Task

The purpose of this chapter is to set up the *CellPath* 300 ports. This includes setting the system clock and configuring the physical characteristics of the interface ports. It does not include establishing port-to-port connections and bandwidth. For information on these tasks, turn to the *CellPath 300 ATM WAN Multiplexer Configuration Manual*.

6.1.1 Filling Out the Configuration Worksheets

As part of system planning, the network administrator should fill out the configuration worksheets located at the back of this manual. There are three types of worksheets:

- *CellPath* 300 System Configuration Worksheet—fill out one of these for each *CellPath* 300 unit.
- Port Worksheets—fill out one of these for each port in the *CellPath* 300 unit. It may be necessary to make duplicates of some of the worksheets if similar port types are installed.
- Remote Access Worksheet—fill out one of these for each *CellPath* 300 unit.

In this chapter enter the parameters from the *CellPath* 300 System Configuration worksheet and from each of the port worksheets. Enter the parameters from the Remote Access Worksheet when performing the installation steps in the next chapter of this manual.

To fill out the worksheets fully it may be necessary to talk to the service carrier or provider. If unsure of some of the parameters discussed in the worksheets, refer to the *CellPath 300 ATM WAN Multiplexer Configuration Manual* for a more in-depth explanation of configuration parameters.

6.1.2 Perform the Steps Sequentially

Once the worksheets are filled out, perform the step-by-step instructions provided in this chapter.

1. Start by performing the system configuration tasks described in Section 6.1.
2. Then turn to Section 6.2 to learn how to access the port configuration screens.
3. Finally, turn to the specific port configuration sections that apply to the system and fill out the screens as described.

6.1.3 Using the Module LEDs

The LEDs located on the front of a protocol module (Figure 6.1) indicate the status of that module and its paired physical layer module. Protocol modules that pair with single-port physical layer modules contain four LEDs, while protocol modules that pair with quad-port physical layer modules contain ten LEDs. To view these LEDs, remove the chassis front cover.

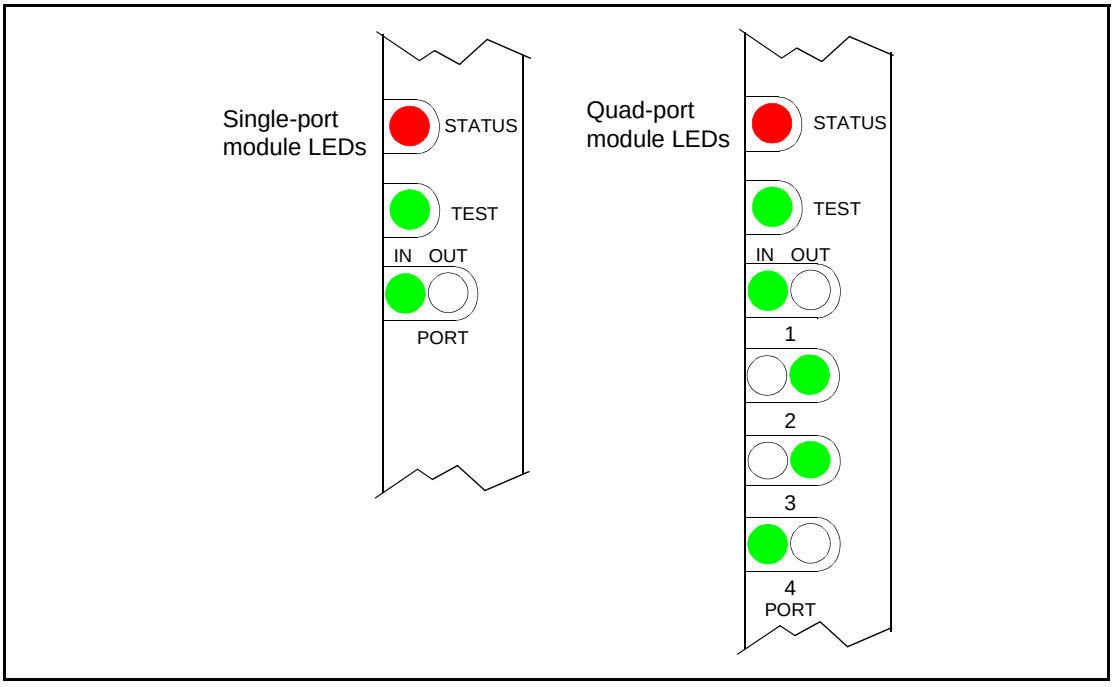

Figure 6.1 - Protocol Module LEDs

Table 6.1 explains the behavior of the LEDs and what should be expected based on the port type and the status of the configuration task.

Table 6.1 - Protocol Module LEDs

	VBR/Packet Port	CBR/CES Port	Cell Port
No physical connection or no PLM	IN = red STATUS = red	IN = red STATUS = red	IN = red STATUS = red
Valid physical connection, No payload, No cell delineation, No port connections / traffic.	IN=off OUT=off STATUS=green	IN=off OUT=off [1] STATUS=green	IN=red STATUS=red
Valid physical connection, Valid payload, Valid cell delineation, No port connections / traffic.	IN=off OUT=off STATUS=green	IN=off OUT=off STATUS=green	IN=off OUT=off STATUS=green
Valid physical connection, Valid payload, Valid cell delineation, Port connections and traffic.	IN=green OUT=green STATUS=green	IN=green OUT=green STATUS=green	IN=green OUT=green STATUS=green

1. The CBR port LED is red if a connection is established, but it is not passing valid traffic. This results in a FIFO underflow at the port.

Except during self-test on power-up, the Test LED is either off or green (indicating a loopback).

A detailed description of LED behavior during normal operation is provided in Appendix B of the *CellPath 300 ATM WAN Multiplexer Installation and Maintenance Manual*.

6.1.4 Setting Up the System Parameters

Set up the system parameters by entering the values from the *CellPath* 300 System Configuration Worksheet into the `System Administration` screen.

Open the `System Administration` screen by selecting the `[System Admin...]` button in the *CellPath* 300 `System Configuration` screen, shown in Figure 6.2.

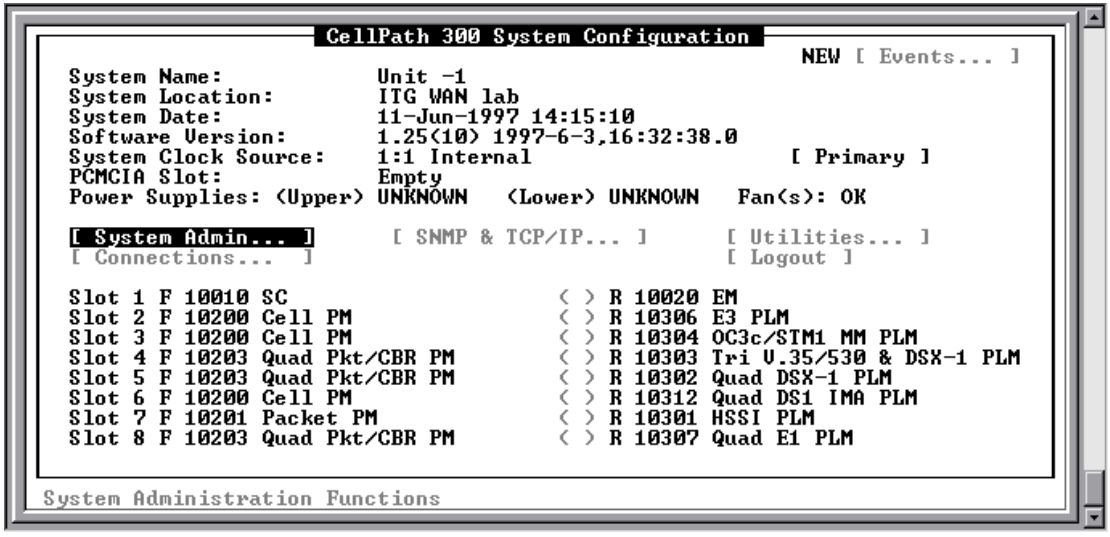

Figure 6.2 - System Configuration Screen

Enter the worksheet values into the `System Administration` screen (Figure 6.3), as described on the next page.

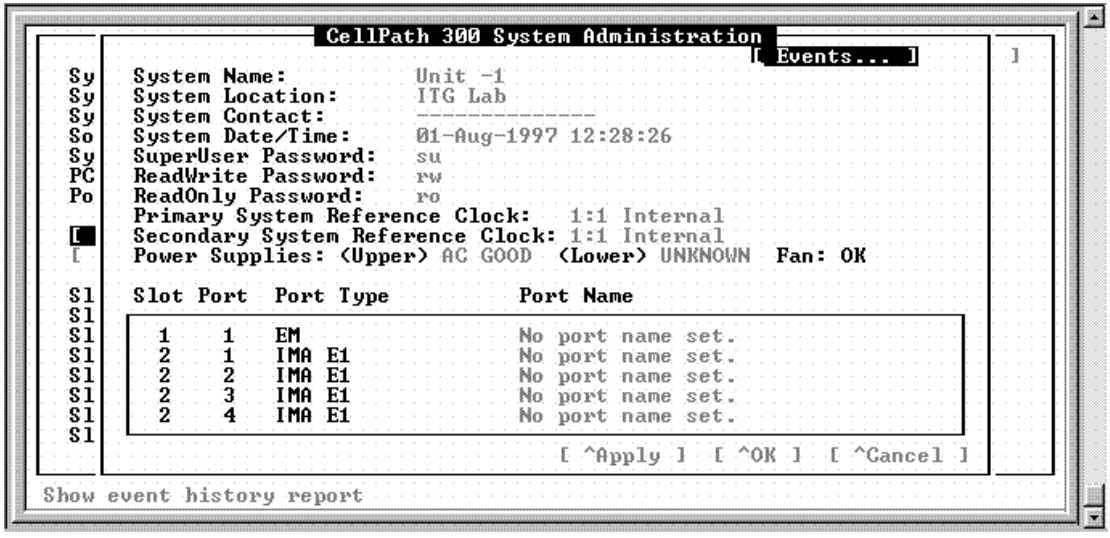

Figure 6.3 - System Administration Screen

If a screen button is preceded by a control ^ symbol, that button can be selected by pressing the Ctrl key and the first letter of the button name. For example, pressing <Ctrl-O> is the same as selecting the [^OK] button on the screen.

1. **Specify the System Name, Location, and Contact.** Each field allows 255 characters. Move between the three fields using the <Tab> key; move between the character positions within a given field by using the left and right arrow keys.
2. **Set the System Date/Time of the *CellPath* 300 real-time clock.** Press the <Tab> key to move to the desired fields. Type in the date and time using the same format as shown in the menu. Set the time a few seconds ahead, then press <Ctrl-A> when the time on the screen matches the local time exactly. This sets the clock.
3. **Specify the source of the Primary and Secondary System Reference Clocks.** For either clock, the source can be the *CellPath* 300 internal oscillator or an external clock signal recovered from the receive data stream at a specific port. Press the <Tab> key to move to the fields. Press <F2> or <Ctrl-P> to display a pop-up list of the clock selections. Use the up and down arrow keys to move between the selections, then press the <ENTER> key to make a selection.
4. **Turn on the Power Supply alarms.** Press the <Tab> key to move to the power supply alarm fields. Press <F2> or <Ctrl-P> to display a pop-up list of the power supply selections: AC, DC, or EMPTY. Use the up and down arrow keys to move between the selections, then press the <ENTER> key to make a selection. (Check the front panel and verify that the LED for each installed power supply is green. The LED for an empty power supply slot should be off.)
5. **Enter Port Names for each interface port.** Enter the port names here or in the individual port configuration screens. Each name can be up to 31 characters long. Press the <Tab> key to move to the first port name field, then use the up and down arrow keys to move between the other port name fields. Press the <Tab> key to exit the port name fields.

When the system parameters have been entered, tab to [^OK] and press <ENTER>. This applies the entered values and returns to the *CellPath* 300 System Configuration screen. The *CellPath* 300 System Configuration screen should reflect the newly entered values.

6.2 Configure the Interface Ports

Access a port's configuration screen by first selecting the physical layer module to which the port is attached.

6.2.1 Accessing the screens

In the *CellPath* 300 `System Configuration` screen (Figure 6.2), select a port's physical layer module to open the port's configuration screen.

6.2.2 Single-port Modules

If the module selected is a single-port module, pressing the `<ENTER>` key opens that port's configuration screen. For example, the DS3 module is a single-port module, therefore pressing `<ENTER>` on that module opens the port configuration screen directly.

6.3 Using the Quad Port Selection Screens

If the PLM selected in the `System Configuration` screen is a quad port module, a quad port selection screen opens. From that screen open the port configuration screen for each of the four ports. On some of the quad port screens the port types can also be changed between VBR and CBR traffic.

6.3.1 Quad DSX-1or E1 PLM

The Quad DSX-1 PLM can be mated with three different protocol modules. When mated with the Quad Packet/CBR PM, the port types can be changed using the `Port Type` field, as shown in Figure 6.4. If mated with any of the other modules, the quad port screen looks similar to the one shown in the figure, but without the `Port Type` field.

The Quad E1 PLM can also be mated with three different protocol modules and uses a similar quad port screen.

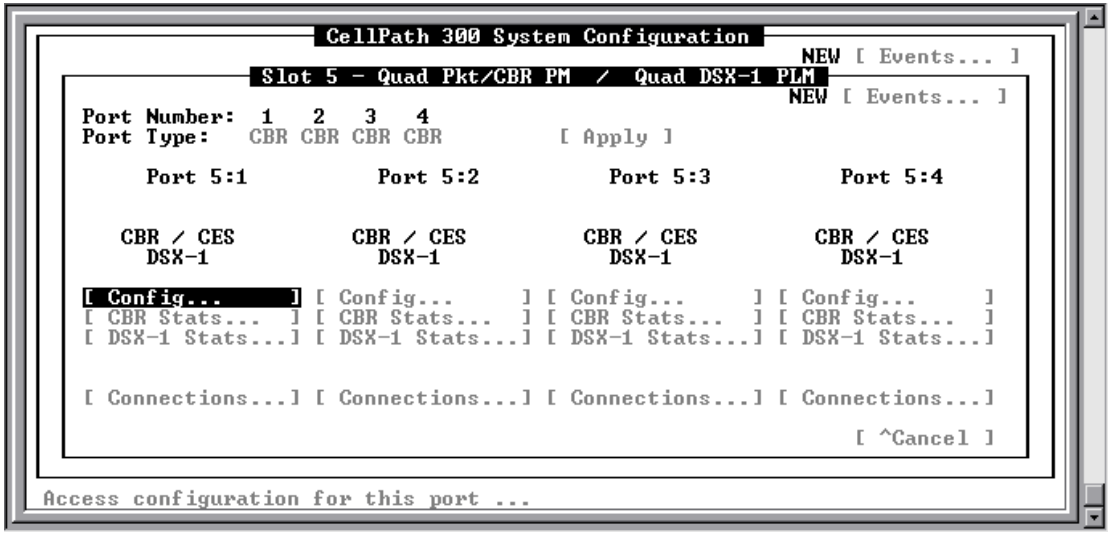

Figure 6.4 - Quad Packet/CBR PM Screen

NOTE

If the `Port Type` field is toggled, the connection is deleted on any port whose port type changes.

6.3.2 Quad V.35/EIA-530 PLM

The Quad V.35/EIA-530 PLM can be mated with two different protocol modules. When mated with the Quad Packet/CBR PM, the port types can be changed using the `Port Type` field, as shown in Figure 6.5. If mated with the Packet PM, the quad port screen looks similar to the one shown in the figure, but without the `Port Type` field.

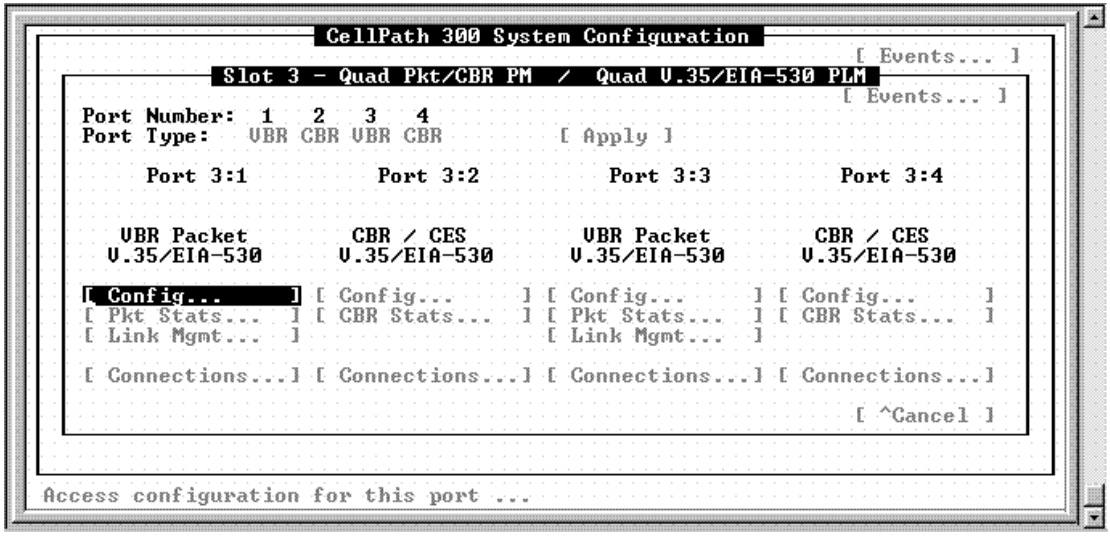

Figure 6.5 - Quad V.35/EIA-530 PLM Screen

6.3.3 Tri V.35/EIA-530 & DSX-1 or Tri V.35/EIA-530 & E1 PLM

The Tri V.35/EIA-530 & E1 can be mated with two different protocol modules. When mated with the Quad Packet/CBR PM, the port types can be changed using the `Port Type` field, as shown in Figure 6.6. If mated with the Quad Packet PM, the quad port screen looks similar to the one shown in the figure, but without the `Port Type` field.

The Tri V.35/EIA-530 & DSX-1 PLM can also be mated with two different protocol modules and uses a similar quad port screen.

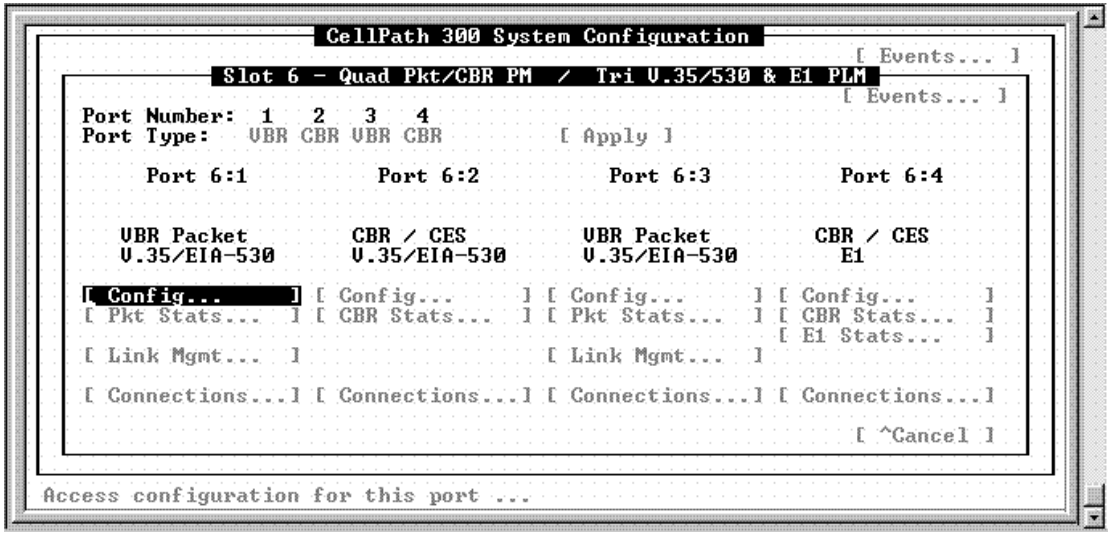

Figure 6.6 - Tri V.35 / EIA-530 PLM Screen

6.4 Cell/OC-3c/STM1 Single-mode

Set up the OC-3c/STM1 port by entering the values from the Cell/OC-3c/STM1 Single- or Multimode Port worksheet.

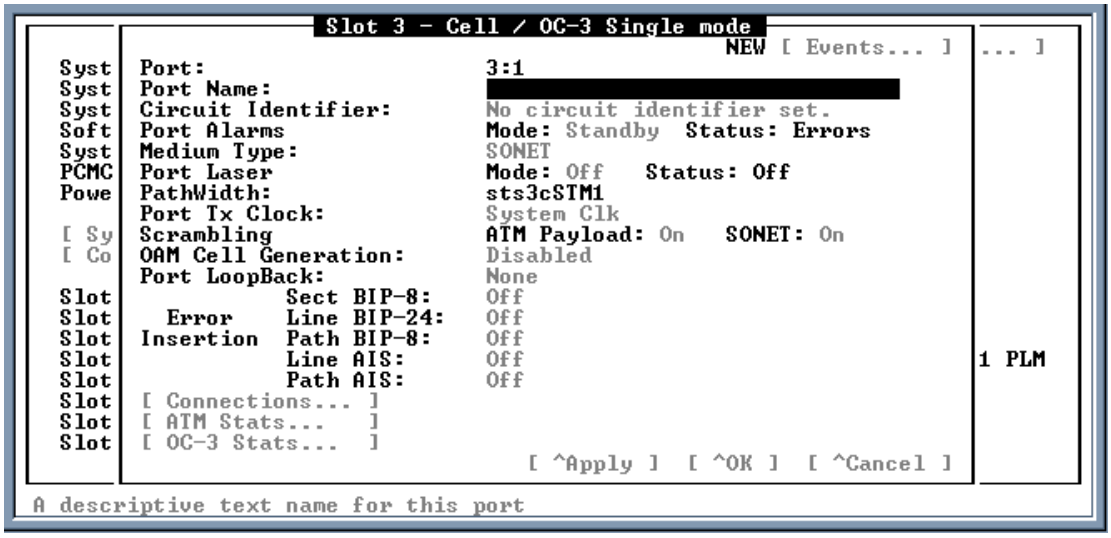

Figure 6.7 - Cell/OC-3c/STM1 Single-mode Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. Enter the port name. Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the circuit's identifier number.** Tab to this field, then type in the identifier. The string can be up to 255 characters.
4. **Specify the medium (framing) type.** Tab to this field, then press the space bar to select SONET (OC-3c) or SDH (STM1).
5. **Pathwidth.** This is a read-only field. It contains the bandwidth of the interface. Only one setting is allowed: sts3cSTM1 (155 Mb).
6. Set the port clock. Tab to this field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock (System Clk) or the clock recovered from the data stream at the port (Loop Rx). Note: if this port is the source of the system reference clock, the transmit clock source for the port should always be set to the system clock.

7. **Specify payload and/or frame scrambling.** Tab to the ATM Payload field and press the space bar to select On or Off for payload scrambling. Then tab to the SONET(SDH) field and press the space bar to select On or Off for frame scrambling. Note that for normal operation, frame scrambling must be set to On. Frame scrambling is only turned Off in rare cases for line verification or testing.
8. **Set the OAM cell generation option.** Enable OAM Cell Generation to allow internally-generated OAM fault management cells to be passed through this cell port. Disable OAM Cell Generation if internally-generated OAM cells are to be prevented from being passed through. (OAM fault management cells that are generated by another device upstream are always passed through.)
9. Set the maximum burst size. Tab to this field, then press the space bar to select 32 cells, 105 cells, 210 cells, or Maximum cells. Choosing any setting other than Maximum disables packet-level discard.
10. Make sure loopbacks are set to None.
11. Make sure error insertion is Off.
12. **Turn on the laser (if a cable is connected at the port).** By default, the laser signal at the port is "off." Turn on the signal by tabbing to the Port Laser Mode field and pressing the space bar.

To transmit data on this port, the laser must first be activated in this screen. The LED on the OC3c/STM1 physical layer module turns red when the laser is active.

Tab to [^Apply] and press <ENTER>. This applies the configuration changes.

13. Verify the port's connection and configuration. Now look at the port's Status field. This field displays OK if the port is properly connected to and configured for its attached network or terminal device.
14. **Turn on the port's alarm reporting.** If the status is OK, tab to the Port Alarm Mode field and press the space bar to turn the mode to Active. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to [^OK] and press <ENTER>. This applies the entered values and returns to the *CellPath* 300 System Configuration screen.

6.5 Cell/OC-3c/STM1 Multimode

Set up the OC-3c/STM1 port by entering the values from the Cell/OC-3c/STM1 Single- or Multimode Port worksheet.

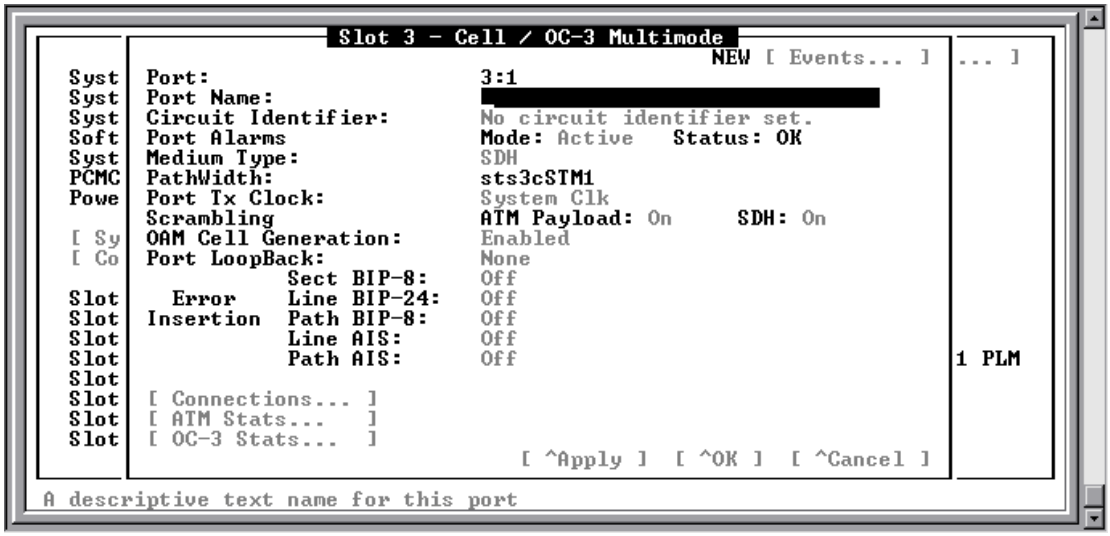

Figure 6.8 - Cell/OC-3c/STM1 Multimode Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the circuit's identifier number.** Tab to this field, then type in the identifier. The string can be up to 255 alphanumeric characters.
4. **Specify the medium (framing) type.** Tab to this field, then press the space bar to select SONET (OC-3c) or SDH (STM1).
5. **Pathwidth.** This is a read-only field. It contains the bandwidth of the interface. Only one setting is allowed: sts3cSTM1 (155 Mbps).
6. Set the port clock. Tab to this field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock (System Clk) or the clock recovered from the data stream at the port (Loop Rx). Note: if this port is the source of the system reference clock, the transmit source clock for the port should always be set to the system clock.

7. **Specify payload and/or frame scrambling.** Tab to the ATM Payload field and press the space bar to select On or Off for payload scrambling. Then tab to the SONET(SDH) field and press the space bar to select On or Off for frame scrambling. Note that for normal operation frame scrambling must be set to On. Frame scrambling is only turned Off in rare cases for line verification or testing.
8. **Set the OAM cell generation option.** Enable OAM Cell Generation if internally-generated OAM fault management cells are to be passed through this cell port. Disable OAM Cell Generation if internally-generated OAM cells are to be prevented from being passed through. (OAM fault management cells that are generated by another device upstream are always passed through.)
9. Set the maximum burst size. Tab to this field, then press the space bar to select 32 cells, 105 cells, 210 cells, or Maximum cells. Choosing any setting other than Maximum disables packet-level discard.
10. Make sure loopbacks are set to None.
11. Make sure error insertion is Off.
12. Tab to [^Apply] and press <ENTER>. This applies the configuration changes.
13. Verify the port's connection and configuration. Now look at the port's Status field. This field displays "OK" if the port is properly connected to and configured for its attached network or terminal device.
14. **Turn on the port's alarm reporting.** If the status is OK, tab to the Port Alarm Mode field and press the space bar to turn the mode to Active. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to [^OK] and press <ENTER>. This applies the entered values and returns to the *CellPath* 300 System Configuration screen.

6.6 Cell/DS3

Set up the Cell / DS3 port by entering the values from the Cell / DS3 Port worksheet.

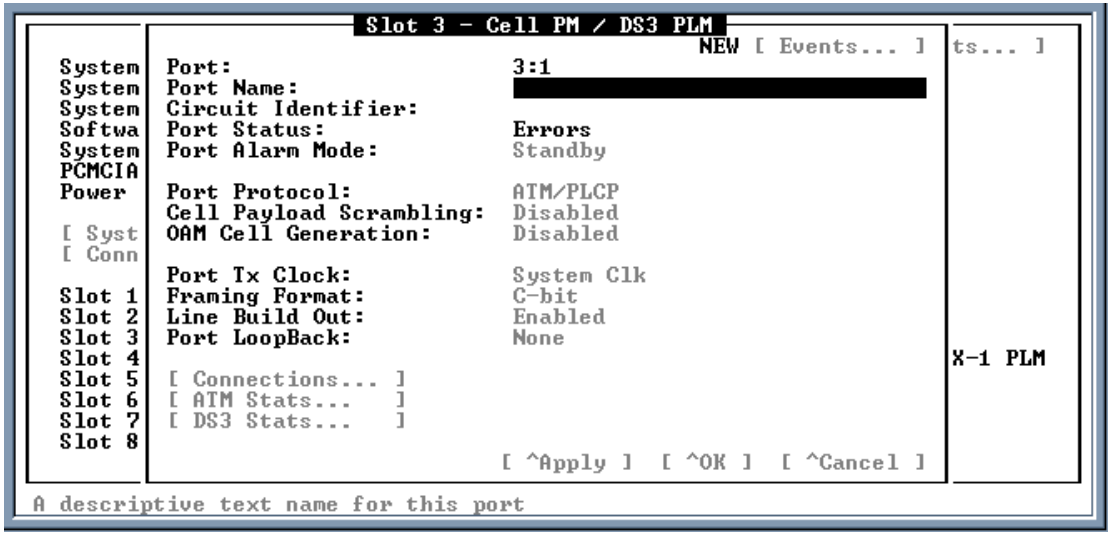

Figure 6.9 - Cell / DS3 Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the circuit's identifier number.** Tab to this field, then type in the identifier. The string can be up to 255 alphanumeric characters.
4. Specify the port protocol and cell delineation. Tab to this field, then press the space bar until the desired selection appears in the field.
5. **Enable or disable payload scrambling.** Tab to this field, then press the space bar to select `Enabled` (on) or `Disabled` (off).
6. **Set the OAM cell generation option.** Enable `OAM Cell Generation` if internally-generated OAM fault management cells are to be passed through this cell port. Disable `OAM Cell Generation` if internally-generated OAM cells are to be prevented from being passed through. (OAM fault management cells that are generated by another device upstream are always passed through.)

7. **Set the maximum burst size.** Tab to this field, then press the space bar to select `32 cells`, `105 cells`, `210 cells`, or `Maximum cells`. Choosing any setting other than `Maximum` disables packet-level discard.
8. **Set the port clock**. Tab to this field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock (System Clk) or the clock recovered from the data stream at the port (Loop Rx). Note: if this port is the source of the system reference clock, then the transmit source clock for the port should be set to the system clock.
9. **Specify the framing format.** Tab to this field, then press the space bar to select either C-bit Parity or M23.
10. **Set the line build-out.** Tab to this field, then press the space bar to select the appropriate line build-out for the cabling attached to the port: `Enabled` (if the nearest piece of equipment is less than 225 ft. away) or `Disabled` (if the nearest piece of equipment is greater than 225 ft. away).
11. Make sure loopbacks are set to `None`.
12. Tab to `[^Apply]` and press `<ENTER>`. This applies the configuration changes.
13. Verify the port's connection and configuration. Now look at the port's `Status` field. This field displays`"OK"` if the port is properly connected to and configured for its attached network or terminal device.
14. **Turn on the port's alarm reporting.** If the status is `OK`, tab to the `Port Alarm Mode` field and press the space bar to turn the mode to `Active`. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the *CellPath* 300 `System Configuration` screen.

6.7 Cell/E3

Set up the Cell/E3 port by entering the values from the Cell/E3 Port worksheet.

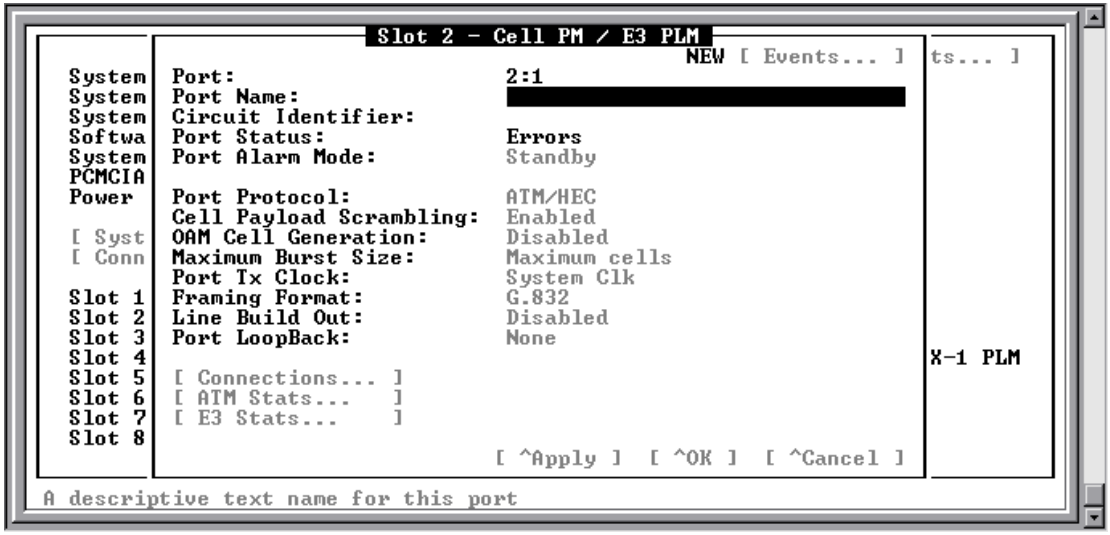

Figure 6.10 - Cell/E3 Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the circuit's identifier number.** Tab to this field, then type in the identifier. The string can be up to 255 alphanumeric characters.
4. Specify the port protocol and cell delineation. Tab to this field, then press the space bar until the desired selection appears in the field.
5. **Enable or disable payload scrambling.** Tab to this field, then press the space bar to select `Enabled` (on) or `Disabled` (off).
6. **Set the OAM cell generation option.** Enable `OAM Cell Generation` if internally-generated OAM fault management cells are to be passed through this cell port. Disable `OAM Cell Generation` if internally-generated OAM cells are to be prevented from being passed through. (OAM fault management cells that are generated by another device upstream are always passed through.)

7. **Set the maximum burst size.** Tab to this field, then press the space bar to select `32 cells`, `105 cells`, `210 cells`, or `Maximum cells`. Choosing any setting other than `Maximum` disables packet-level discard.
8. **Set the port clock.** Tab to this field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock (System Clk) or the clock recovered from the data stream at the port (Loop Rx). Note: if this port is the source of the system reference clock, the transmit source clock for the port should be set to the system clock.
9. **Specify the framing format.** Tab to this field, then press the space bar to select either G.832 or G.751.
10. **Set the line build-out.** Tab to this field, then press the space bar to select the appropriate line build-out for the cabling attached to the port: `Enabled` (if the nearest piece of equipment is less than 225 ft. away) or `Disabled` (if the nearest piece of equipment is greater than 225 ft. away).
11. Make sure loopbacks are set to `None`.
12. Tab to `[^Apply]` and press `<ENTER>`. This applies the configuration changes.
13. Verify the port's connection and configuration. Now look at the port's `Status` field. This field displays `"OK"` if the port is properly connected to and configured for its attached network or terminal device.
14. **Turn on the port's alarm reporting.** If the status is `OK`, tab to the `Port Alarm Mode` field and press the space bar to turn the mode to Active. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the *CellPath* 300 `System Configuration` screen.

6.8 Cell/J2

Set up the Cell / J2 port by entering the values from the Cell / J2 Port worksheet.

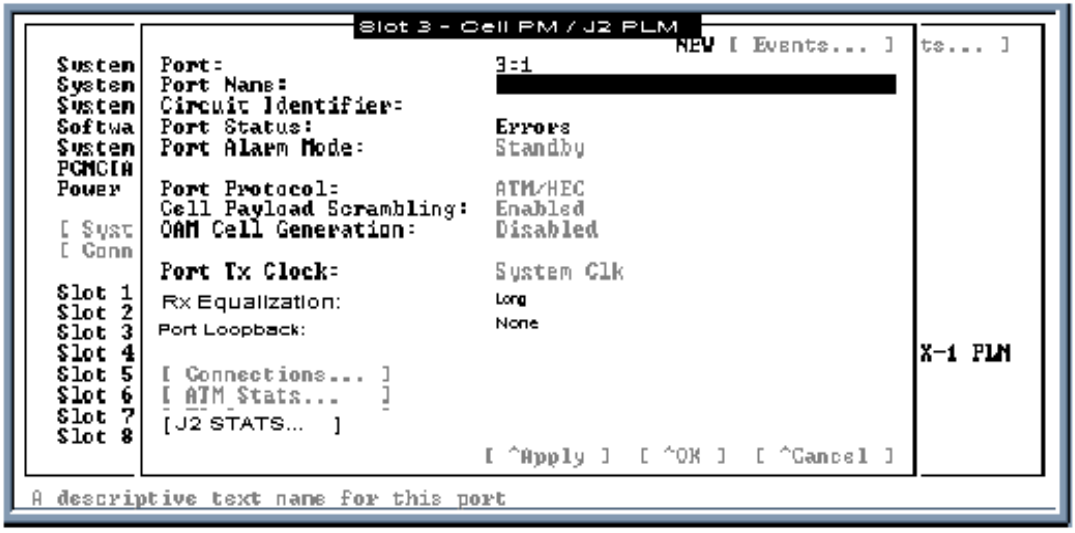

Figure 6.11 - Cell / J2 Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the circuit's identifier number.** Tab to this field, then type in the identifier. The string can be up to 255 alphanumeric characters.
4. Port protocol and cell delineation. This field is read-only.
5. **Enable or disable payload scrambling.** Tab to this field, then press the space bar to select `Enabled` (on) or `Disabled` (off).
6. **Set the OAM cell generation option.** Enable `OAM Cell Generation` if internally-generated OAM fault management cells are to be passed through this cell port. Disable `OAM Cell Generation` if internally-generated OAM cells are to be prevented from being passed through. (OAM fault management cells that are generated by another device upstream are always passed through.)

7. Set the maximum burst size. Tab to this field, then press the space bar to select `32 cells`, `105 cells`, `210 cells`, or `Maximum cells`. Choosing any setting other than `Maximum` disables packet-level discard.
8. Set the port clock. Tab to this field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock (System Clk) or the clock recovered from the data stream at the port (Loop Rx). Note: if this port is the source of the system reference clock, the transmit source clock for the port should be set to the system clock.
9. **Set the Rx Equalization option.** Tab to this field, then press the space bar to select either `<120M` (normal setting) or `>120M` (when the port is attached to a long cable and is experiencing bit-error-rate problems).
10. Make sure loopbacks are set to `None`.
11. Tab to `[^Apply]` and press `<ENTER>`. This applies the configuration changes.
12. Verify the port's connection and configuration. Now look at the port's `Status` field. This field displays `"OK"` if the port is properly connected to and configured for its attached network or terminal device.
13. **Turn on the port's alarm reporting.** If the status is `OK`, tab to the `Port Alarm Mode` field and press the space bar to turn the mode to `Active`. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the *CellPath* 300 `System Configuration` screen.

6.9 Cell/DSX-1

Set up the Cell / DSX-1 port by entering the values from the Cell / DSX-1 Port worksheet.

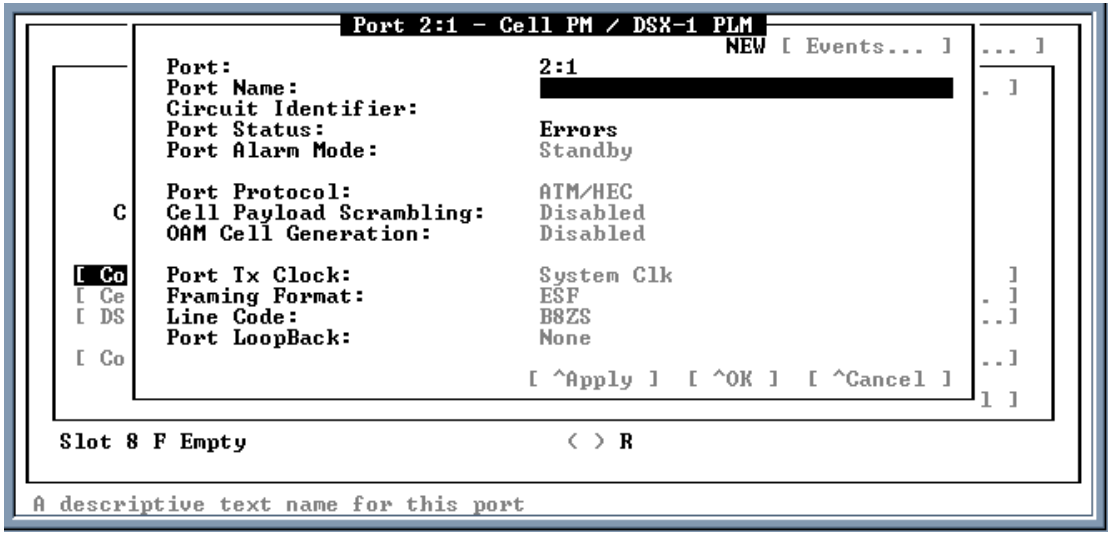

Figure 6.12 - Cell / DSX-1 Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the circuit's identifier number.** Tab to this field, then type in the identifier. The string can be up to 255 alphanumeric characters.
4. Specify the port protocol and cell delineation. Tab to this field, then press the space bar until the desired selection appears in the field.
5. **Enable or disable payload scrambling.** Tab to this field, then press the space bar to select `Enabled` (on) or `Disabled` (off).
6. **Set the OAM cell generation option.** Enable `OAM Cell Generation` if internally-generated OAM fault management cells are to be passed through this cell port. Disable `OAM Cell Generation` if internally-generated OAM cells are to be prevented from being passed through. (OAM fault management cells that are generated by another device upstream are always passed through.)

7. Set the port clock. Tab to this field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock (System Clk) or the clock recovered from the data stream at the port (Loop Rx). Note: if this port is the source of the system reference clock, the transmit source clock for the port should always be set to the system clock.
8. **Specify the framing format.** Tab to this field, then press the space bar to select extended super frame (ESF) or super frame (SF).
9. **Set the line coding.** Tab to this field, then press the space bar to select `B8ZS` or `AMI`.
10. Make sure loopbacks are set to `None`.
11. Tab to `[^Apply]` and press `<ENTER>`. This applies the configuration changes.
12. Verify the port's connection and configuration. Now look at the port's `Status` field. This field displays `OK` if the port is properly connected to and configured for its attached network or terminal device.
13. **Turn on the port's alarm reporting.** If the status is `OK`, tab to the `Port Alarm Mode` field and press the space bar to turn the mode to `Active`. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the *CellPath* 300 `System Configuration` screen.

6.10 Cell/E1

Set up the Cell/E1 port by entering the values from the Cell/E1 Port worksheet.

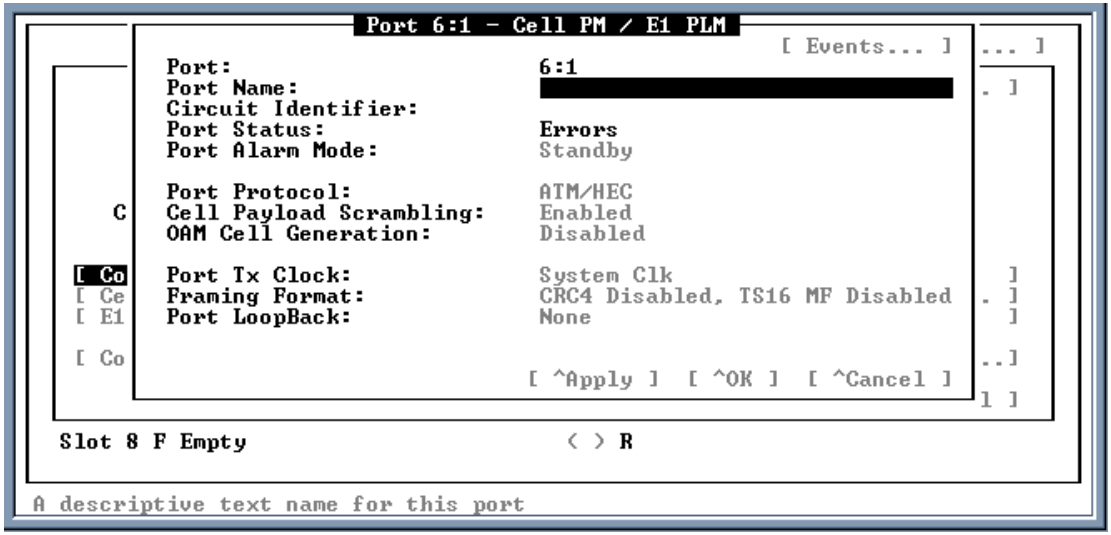

Figure 6.13 - Cell/E1 Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the circuit's identifier number.** Tab to this field, then type in the identifier. The string can be up to 255 alphanumeric characters.
4. Specify the port protocol and cell delineation. Tab to this field, then press the space bar until the desired selection appears in the field.
5. **Enable or disable payload scrambling.** Tab to this field, then press the space bar to select `Enabled` (on) or `Disabled` (off).
6. **Set the OAM cell generation option.** Enable `OAM Cell Generation` if internally-generated OAM fault management cells are to be passed through this cell port. Disable `OAM Cell Generation` if internally-generated OAM cells are to be prevented from being passed through. (OAM fault management cells that are generated by another device upstream are always passed through.)

7. Set the port clock. Tab to this field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock (System Clk) or the clock recovered from the data stream at the port (Loop Rx). Note: if this port is the source of the system reference clock, the transmit source clock for the port should always be set to the system clock.
8. **Set framing format.** Toggle through four options to match the framing to the network or terminal equipment connected to this port.
9. Make sure loopbacks are set to `None`.
10. Tab to `[^Apply]` and press `<ENTER>`. This applies the configuration changes.
11. Verify the port's connection and configuration. Now look at the port's `Status` field. This field displays `OK`" if the port is properly connected to and configured for its attached network or terminal device.
12. **Turn on the port's alarm reporting.** If the status is `OK`, tab to the `Port Alarm Mode` field and press the space bar to turn the mode to `Active`. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the *CellPath* 300 `System Configuration` screen.

6.11 Cell/IMA DS1 Group

Set up the Cell/IMA DS1 group by entering the values from the Cell/IMA DS1 worksheet. Next, select the links to include in the group and then enable them as a group. Then, configure each of the links to be used.

Figure 6.14 - Cell/IMA DS1 Group Screen

1. **Enter the circuit's identifier number.** Tab to this field, then type in the identifier. The string can be up to 255 alphanumeric characters.
2. **Designate the number of redundant links.** Tab to this field to specify the number of links in the group that can fail before the group shuts down and stops transmitting traffic. The options are `0`, `1`, `2`, `3`, or `4`. The default `4` setting causes the group to stay active until all links in the group fail. If a group shuts down for crossing the redundant link threshold, it will return to service once the appropriate number of links return.
3. **Enable or disable payload scrambling.** Tab to this field, then press the space bar to select `Enabled` (on) or `Disabled` (off).
4. **Set the OAM cell generation option.** Enable `OAM Cell Generation` if internally-generated OAM fault management cells are to be passed through this cell port. Disable `OAM Cell Generation` if internally-generated OAM cells are to be prevented from being passed through. (OAM fault management cells that are generated by another device upstream are always passed through.)

5. Set the maximum burst size. Tab to this field, then press the space bar to select `32 cells`, `105 cells`, `210 cells`, or `Maximum cells`. Choosing any setting other than `Maximum` disables packet-level discard.
6. **Set the group transmit clock.** This field specifies the source of the transmit clock for the four links in this group. Tab to the field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock (System Clk) or the clock recovered from the data stream at the link (Loop Rx).
7. **Line code.** This field is read-only.
8. **Specify the framing format.** Tab to this field, then press the space bar to select extended super frame (`ESF`) or super frame (`SF/D4`).
9. **Specify line build out attenuation.** Tab to this field, then press the space bar to select 0.0 dB (no attenuation), 7.5 dB, 15.0 dB, or 22.5 dB.
10. **Make sure loopbacks are set to None.** Tab to `[^Apply]` and press <ENTER>. This applies the configuration changes.

6.11.1 Configuring the IMA Group

Use the `IMA Group Configuration` screen (Figure 6.15) to select the links to include in the group and then enable them as a group. The links are individually set to `Enable` by default.

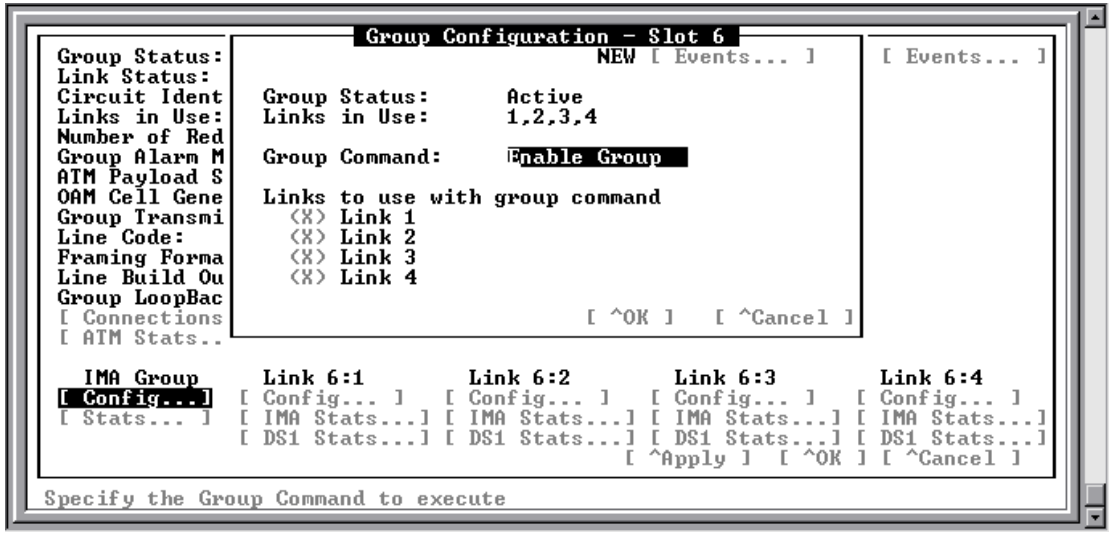

Figure 6.15 - IMA Group Configuration Screen

1. **Group command.** Tab to this field, then press the space bar to choose `Enable Group` or `Disable Group`. Each link that is specified to be included in the group must be enabled and its status `OK`.

   After initial configuration, when the group is enabled and operational, the Add link or Delete link commands can also be used. To add a link, first Enable the link on one end, then Enable and Add the link on the other end; the link first enabled is added automatically. If add a link is added before the link at the other end is enabled, an alarm is generated and the group must be disabled and started again. The number of included links must always be the same on both ends.

   The first time this screen is opened, the field displays No operation (except when group configuration options have been applied via SNMP); thereafter the most recently-selected option appears in this field.

2. **Links to use with group command.** Tab to the Link and press the space bar to toggle between (X) and ( ). (X) specifies that a link is to be included in the group command; ( ) means that a link cannot be included in the group command.
3. **Verify the group's connection and configuration.** Now return to the previous screen and look at the `Group Status` and `Link Status` fields. These status fields display `Active` or `OK` if the links in the group are properly connected and configured. The `Links in Use` field shows which links are configured and active.
4. **Turn on the group's alarm reporting.** If the status is `OK`, tab to the `Group Alarm Mode` field and press the space bar to turn the mode to `Active`. This turns on alarm reporting for the group.

When the group configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the *CellPath* 300 `System Configuration` screen.

6.11.2 Configuring the Link

Use the Link Configuration screen to enable or disable Link Use Mode, enable or disable Link Alarm Mode, or give the link a descriptive name.

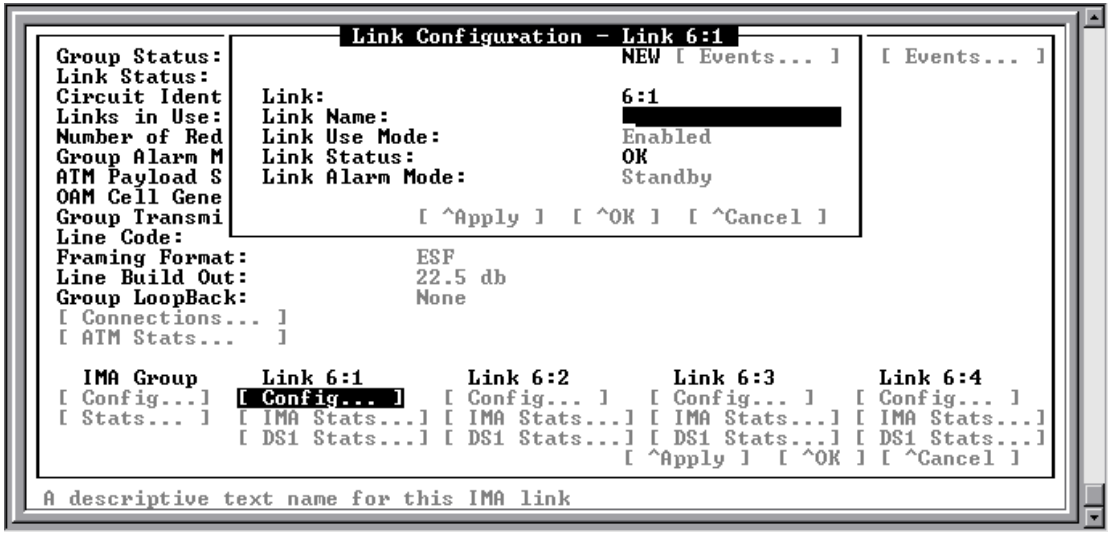

Figure 6.16 - Link Configuration Screen

1. **Link.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:link*.
2. **Enter the link name.** Enter the name for the link here or in the System Administration screen. The string can be up to 31 characters.
3. **Link Use Mode.** This field defaults to Enable to allow the link's participation in the group. Set this field to Disable if it is not included in the group. Alarms may be generated when an enabled link is not included in the group.
4. Verify the link's connection and configuration. Now look at the Link Status field. This field displays OK if the link is properly connected to and configured for its attached network or terminal device.
5. **Turn on the link's alarm reporting.** If the status is OK, tab to the Link Alarm Mode field and press the space bar to turn the mode to Active. This turns on alarm reporting for the link. However, if a link to be remotely added to the group is enabled, disable Link Alarm Mode.

When the link configuration parameters have been entered, tab to [^OK] and press <ENTER>. This applies the entered values and returns to the Group Configuration screen.

6.12 Cell/IMA E1 Group

Set up the Cell/IMA E1 group by entering the values from the Cell/IMA E1 Group worksheet. Next, select the links to include in the group and then enable them as a group. Then, configure each of the links to be used.

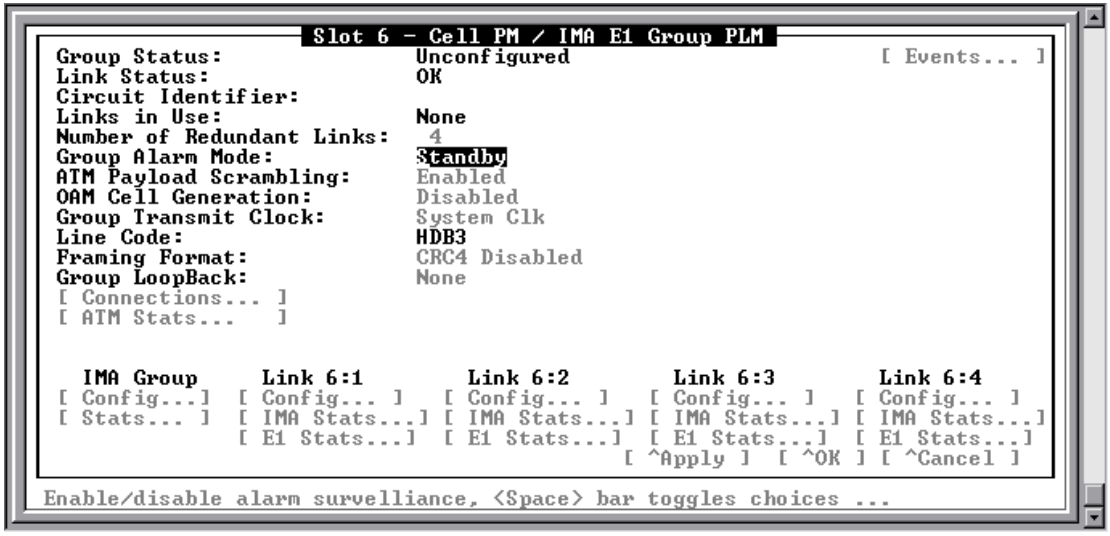

Figure 6.17 - Cell/IMA E1 Group Screen

Circuit's Identifier — Tab to this field, then type in the identifier. The string can be up to 255 alphanumeric characters.

Number of Redundant Links — Tab to this field to specify the number of links in the group that can fail before the group shuts down and stops transmitting traffic. The options are `0`, `1`, `2`, `3`, or `4`. The default `4` setting causes the group to stay active until all links in the group fail. If a group shuts down for crossing the redundant link threshold, it will return to service once the appropriate number of links return.

ATM Payload Scrambling — Tab to this field, then press the space bar to select `Enabled` (on) or `Disabled` (off).

OAM Cell Generation Enable `OAM Cell Generation` if internally-generated OAM fault management cells are to be passed through this cell port. Disable `OAM Cell Generation` if internally-generated OAM cells are to be prevented from being passed through. (OAM fault management cells that are generated by another device upstream are always passed through.)

Set the maximum burst size. Tab to this field, then press the space bar to select `32 cells, 105 cells, 210 cells,` or `Maximum cells`. Choosing any setting other than `Maximum` disables packet-level discard.

Group Transmit Clock This field specifies the source of the transmit clock for the four links in this group. Tab to the field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock (System Clk) or the clock recovered from the data stream at the link (Loop Rx).

Line Code This field is read-only.

Framing Format Tab to this field, then press the space bar to select `CRC4 Enabled` or `CRC4 Disabled`.

Make sure loopbacks are set to `None`. Tab to `[^Apply]` and press `<ENTER>`. This applies the configuration changes.

6.12.1 Configuring the Group

Use the `Group Configuration` screen to select the links to include in the group and then enable them as a group. The links are individually set to `Enable` by default.

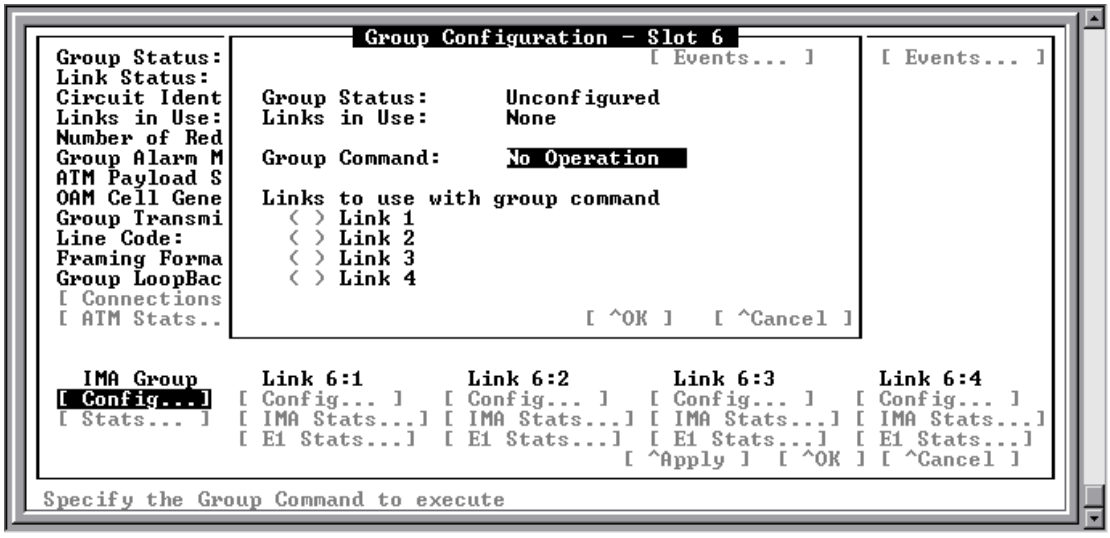

Figure 6.18 - IMA Group Configuration Screen

Group command. Tab to this field, then press the space bar to choose `Enable Group` or `Disable Group`. Each link that is specified to be included in the group must be enabled and its status `OK`.

After initial configuration, when the group is enabled and operational, the `Add link` or `Delete link` commands can also be used. To add a link, first `Enable` the link on one end, then `Enable` and `Add` the link on the other end; the link first enabled is added automatically. If a link is added before the link at the other end is enabled, an alarm is generated and the group must be disabled and started again. The number of included links must always be the same on both ends.

The first time this screen is opened, the field displays No operation (except when group configuration options have been applied via SNMP); thereafter the most recently-selected option appears in this field.

Links in use. Tab to the Link and press the space bar to toggle between `(X)` and `( )`. `(X)` specifies that a link is to be included in the group command; `( )` means that a link is not to be included in the group command.

Verify the group's connection and configuration. Now return to the previous screen and look at the `Group Status` and `Link Status` fields. These status fields display `Active` or `OK` if the links in the group are properly connected and configured. The `Links in Use` field shows which links are configured and active.

Turn on the group's alarm reporting. If the status is OK, tab to the Group Alarm Mode field and press the space bar to turn the mode to Active. This turns on alarm reporting for the group.

When the group configuration parameters have been entered, tab to [^OK] and press <ENTER>. This applies the entered values and returns to the *CellPath* 300 System Configuration screen.

6.12.2 Configuring the Link

Use the Link Configuration screen if Link Use Mode or Alarm Mode is to be enabled or disabled, or give the link a descriptive name.

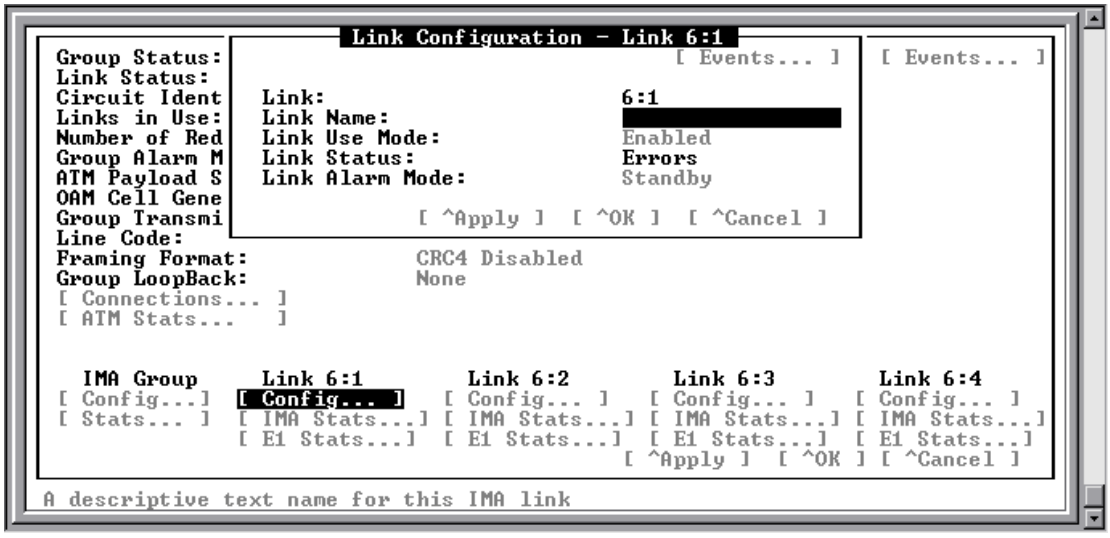

Figure 6.19 - Link Configuration Screen

Link — This is a read-only field. It identifies the port location in the chassis. The format is *slot:link*.

Link Name — Enter the name for the link here or in the System Administration screen. The string can be up to 31 characters.

Link Use Mode — This field defaults to Enable to allow the link's participation in the group. Set this field to Disable if it is not included in the group. Alarms may be generated when an enabled link is not included in the group.

Link Status Verify the link's connection and configuration. Now look at the `Link Status` field. This field displays `OK` if the link is properly connected to and configured for its attached network or terminal device.

Link Alarm Mode If the status is `OK`, tab to the `Link Alarm Mode` field and press the space bar to turn the mode to `Active`. This turns on alarm reporting for the link. However, if a link is to be remotely added to the group, disable `Link Alarm Mode`.

When the link configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the `Group Configuration` screen.

6.13 Packet/DS3

Set up the Packet / DS3 port by entering the values from the Packet / DS3 Port worksheet.

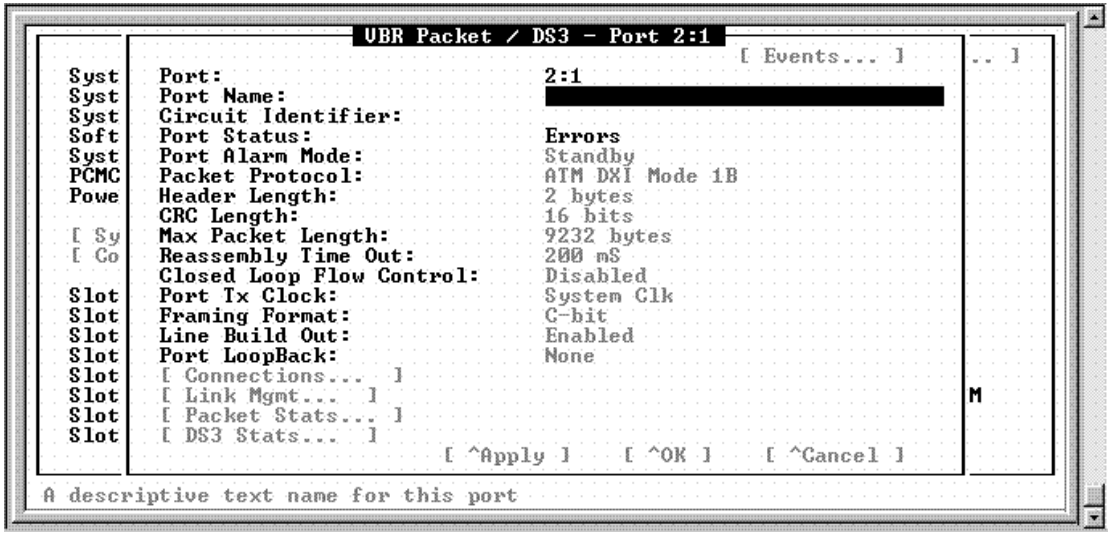

Figure 6.20 - Packet / DS3 Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the circuit's identifier number.** Tab to this field, then type in the identifier. The string can be up to 255 alphanumeric characters.
4. **Enter the packet protocol for the port.** Tab to this field, then press the space bar until the desired selection appears in the field.
5. **Specify the header length for ATM DXI or Frame Relay packets.** If the packet protocol is ATM DXI or Frame Relay UNI, specify the header length of the packets. Tab to the `Header Length` field, then press the space bar to select `2-byte` headers or `4-byte` headers. (This field has no effect on other packet protocols.)
6. Specify the CRC length for error checking. Tab to this field, then press the space bar to select either `16-` or `32-bit` error checking.
7. **Specify the maximum packet length.** Tab to this field, then press the space bar until the desired packet length appears in the field.

8. **Specify the reassembly time-out period.** Tab to this field, then press the space bar to select `100, 200, 500,` or `1000` ms.
9. **Enable or disable closed loop flow control.** Tab to this field, then press the space bar to select `Enabled` (to buffer the data going to the output line), or `Disabled` (to turn off this buffering mode).
10. **Set the port clock.** Tab to this field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock (System Clk) or the clock recovered from the data stream at the port (Loop Rx). Note: if this port is the source of the system reference clock, the transmit source clock for the port should always be set to the system clock.
11. **Specify the framing format.** Tab to this field, then press the space bar to select either `C-bit Parity` or `M23`.
12. **Set the line build-out.** Tab to this field, then press the space bar to select the appropriate line build-out for the cabling attached to the port: `Enabled` (if the nearest piece of equipment is less than 225 ft. away) or `Disabled` (if the nearest piece of equipment is greater than 225 ft. away).
13. Make sure loopbacks are set to `None`.
14. Tab to `[^Apply]` and press `<ENTER>`. This applies the configuration changes.
15. Verify the port's connection and configuration. Now look at the port's `Status` field. This field displays `OK"` if the port is properly connected to and configured for its attached network or terminal device.
16. **Turn on the port's alarm reporting.** If the status is `OK`, tab to the `Port Alarm Mode` field and press the space bar to turn the mode to `Active`. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the *CellPath* 300 `System Configuration` screen.

6.14 Packet/E3

Set up the Packet/E3 port by entering the values from the Packet/E3 Port worksheet.

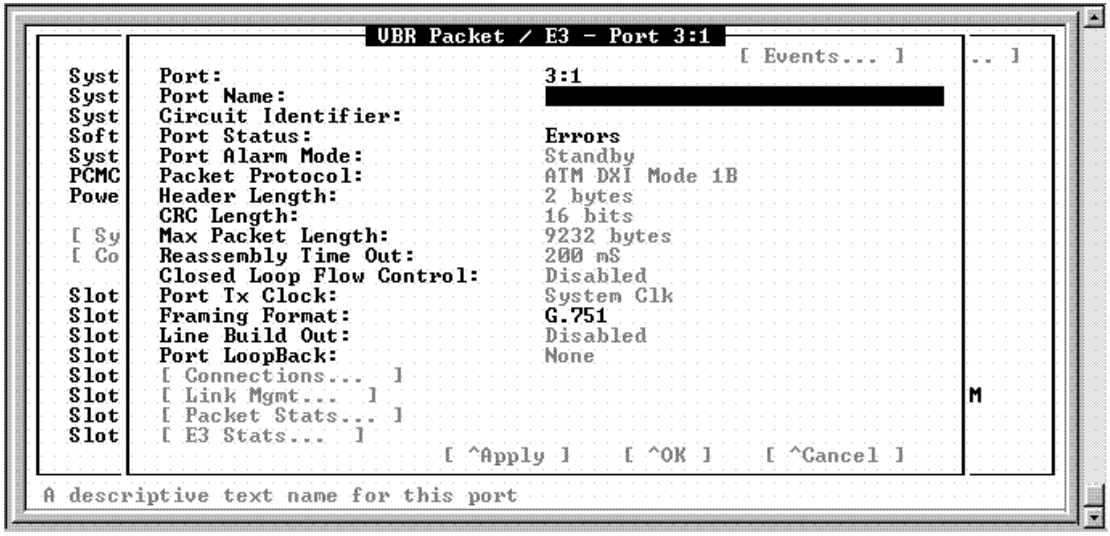

Figure 6.21 - Packet/E3 Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the circuit's identifier number.** Tab to this field, then type in the identifier. The string can be up to 255 alphanumeric characters.
4. **Enter the packet protocol for the port.** Tab to this field, then press the space bar until the desired selection appears in the field.
5. **Specify the header length for ATM DXI or Frame Relay packets.** If the packet protocol is ATM DXI or Frame Relay UNI, specify the header length of the packets. Tab to the `Header Length` field, then press the space bar to select `2-byte` headers or `4-byte` headers. (This field has no effect on other packet protocols.)
6. Specify the CRC length for error checking. Tab to this field, then press the space bar to select `16-` or `32-bit` error checking.
7. **Specify the maximum packet length.** Tab to this field, then press the space bar until the desired packet length appears in the field.

8. **Specify the reassembly time-out period.** Tab to this field, then press the space bar to select `100, 200, 500,` or `1000` ms.
9. **Enable or disable closed loop flow control.** Tab to this field, then press the space bar to select `Enabled` (to buffer the data going to the output line), or `Disabled` (to turn off this buffering mode).
10. **Set the port clock.** Tab to this field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock (System Clk) or the clock recovered from the data stream at the port (Loop Rx). Note: if this port is the source of the system reference clock, the transmit source clock for the port should always be set to the system clock.
11. **Framing format.** This field is read-only.
12. **Set the line build-out.** Tab to this field, then press the space bar to select the appropriate line build-out for the cabling attached to the port: `Enabled` (if the nearest piece of equipment is less than 225 ft. away) or `Disabled` (if the nearest piece of equipment is greater than 225 ft. away).
13. Make sure loopbacks are set to `None`.
14. Tab to `[^Apply]` and press `<ENTER>`. This applies the configuration changes.
15. Verify the port's connection and configuration. Now look at the port's `Status` field. This field displays `OK` if the port is properly connected to and configured for its attached network or terminal device.
16. **Turn on the port's alarm reporting.** If the status is `OK`, tab to the `Port Alarm Mode` field and press the space bar to turn the mode to `Active`. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the *CellPath* 300 `System Configuration` screen.

6.15 Packet/J2

Set up the Packet / J2 port by entering the values from the Packet / J2 Port worksheet.

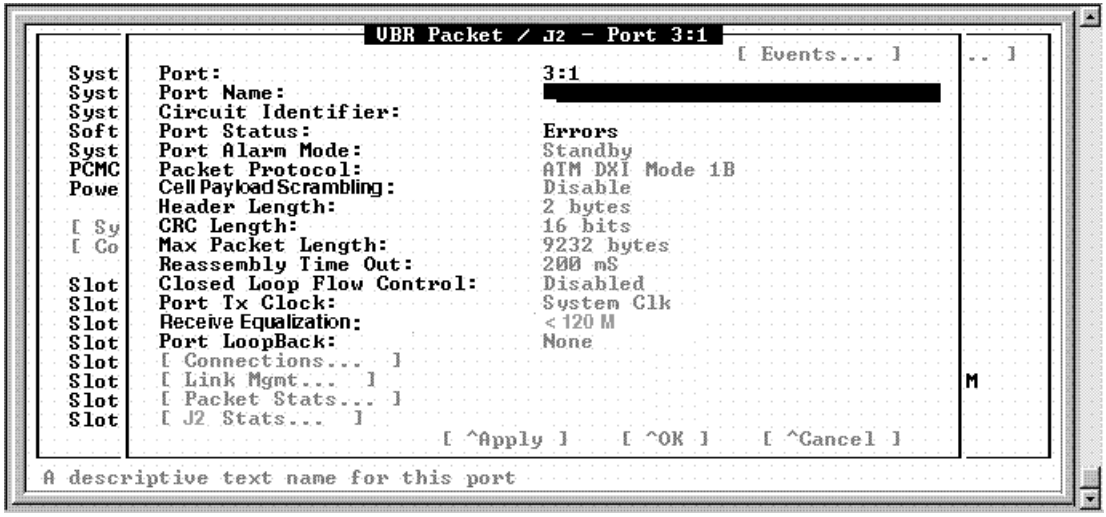

Figure 6.22 - Packet / J2 Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the circuit's identifier number.** Tab to this field, then type in the identifier. The string can be up to 255 alphanumeric characters.
4. **Enter the packet protocol for the port.** Tab to this field, then press the space bar until the desired selection appears in the field.
5. **Specify the header length for ATM DXI or Frame Relay packets.** If the packet protocol is ATM DXI or Frame Relay UNI, specify the header length of the packets. Tab to the `Header Length` field, then press the space bar to select `2-byte` headers or `4-byte` headers. (This field has no effect on other packet protocols.)
6. Specify the CRC length for error checking. Tab to this field, then press the space bar to select `16-` or `32-bit` error checking.
7. **Specify the maximum packet length.** Tab to this field, then press the space bar until the desired packet length appears in the field.

8. Specify the reassembly time-out period. Tab to this field, then press the space bar to select `100, 200, 500,` or `1000` ms.
9. **Enable or disable closed loop flow control.** Tab to this field, then press the space bar to select `Enabled` (to buffer the data going to the output line), or `Disabled` (to turn off this buffering mode).
10. Set the port clock. Tab to this field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock (System Clk) or the clock recovered from the data stream at the port (Loop Rx). Note: if this port is the source of the system reference clock, the transmit source clock for the port should be set to the system clock.
11. **Set the Rx Equalization option.** Tab to this field, then press the space bar to select either `<120M` (normal setting) or `>120M` (when the port is attached to a long cable and is experiencing bit-error-rate problems).
12. Make sure loopbacks are set to `None`.
13. Tab to `[^Apply]` and press `<ENTER>`. This applies the configuration changes.
14. Verify the port's connection and configuration. Now look at the port's `Status` field. This field displays `OK` if the port is properly connected to and configured for its attached network or terminal device.
15. **Turn on the port's alarm reporting.** If the status is `OK`, tab to the `Port Alarm Mode` field and press the space bar to turn the mode to `Active`. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the *CellPath* 300 `System Configuration` screen.

6.16 Packet (10201)/V.35/EIA-530

Set up the Packet / V.35 or EIA-530 port by entering the values from the Packet / V.35 / EIA-530 Port worksheet.

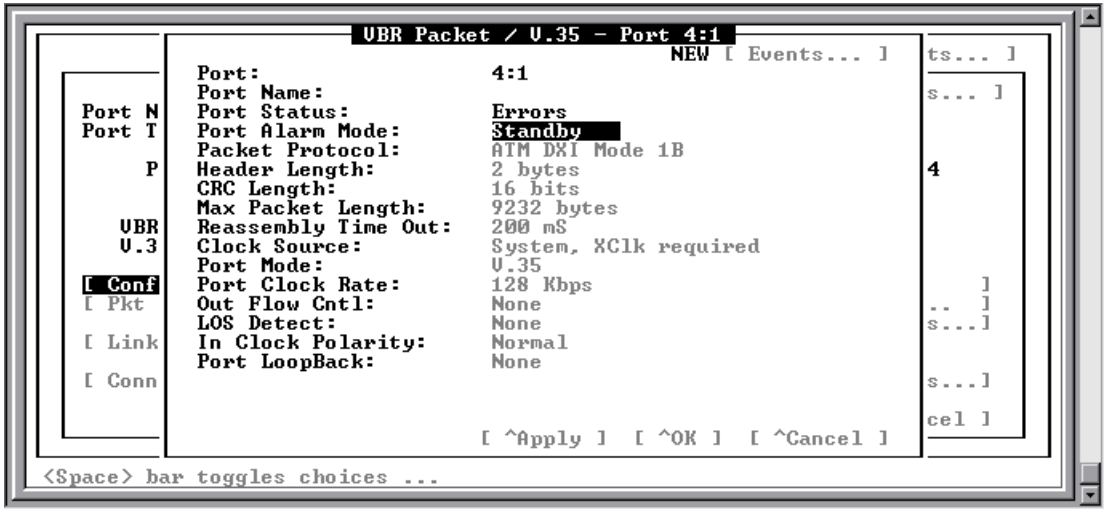

Figure 6.23 - Packet / V.35 / EIA-530 Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the packet protocol for the port.** Tab to this field, then press the space bar until the desired selection appears in the field.
4. **Specify the header length for ATM DXI or Frame Relay packets.** If the packet protocol is ATM DXI or Frame Relay UNI, specify the header length of the packets. Tab to the `Header Length` field, then press the space bar to select `2-byte` headers or `4-byte` headers. (This field has no effect on other packet protocols.)
5. Specify the CRC length for error checking. Tab to this field, then press the space bar to select `16-` or `32-bit` error checking.
6. **Specify the maximum packet length.** Tab to this field, then press the space bar until the desired packet length appears in the field.

7. Specify the reassembly time-out period. Tab to this field, then press the space bar to select `100, 200, 500,` or `1000` ms.
8. **Enable or disable closed loop flow control.** Tab to this field, then press the space bar to select `Enabled` (to buffer the data going to the output line), or `Disabled` (to turn off this buffering mode).
9. **Set the clock source.** Tab to this field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock source (System, XClk required) or an external clock received from the attached terminal device (Loop XClk). The `System Clk, no XClk required` option when the *CellPath* 300 is to provide the timing reference for the network or terminal equipment attached to this port can also be used, but the equipment does not supply a synchronized external clock.
10. Set the port mode. Tab to this field, then press the space bar to select `V.35` or `EIA-530`. (Select `EIA-530` for RS449 and X.21.)
11. Specify the port clock rate. Tab to this field and press `<F2>` or `<Ctrl-P>`. This pops up a list of allowed port clock rates. Use the up and down arrow keys to select the clock rate appropriate for the equipment attached to the port. Press the `<Tab>` key to exit the pop-up.
12. **Set the "out" flow control.** Tab to this field, then press the space bar to select the signaling to be used for output (transmit) flow control.
13. **Set the LOS detect control.** Tab to this field, then press the space bar to select the signaling to be used for detecting LOS at the port.
14. **Set the polarity of the receive clock.** Tab to this field, then press the space bar to select `Normal`, or select `Inverted` to invert the clock if experiencing problems with errored data.
15. Make sure loopbacks are set to `None`.
16. Tab to `[^Apply]` and press `<ENTER>`. This applies the configuration changes.
17. Verify the port's connection and configuration. Now look at the port's `Status` field. This field displays `OK` if the port is properly connected to and configured for its attached terminal device.
18. **Turn on the port's alarm reporting.** If the status is `OK`, tab to the `Port Alarm Mode` field and press the space bar to turn the mode to `Active`. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the *CellPath* 300 `System Configuration` screen.

6.17 Packet/HSSI

Set up the Packet / HSSI port by entering the values from the Packet / HSSI Port worksheet.

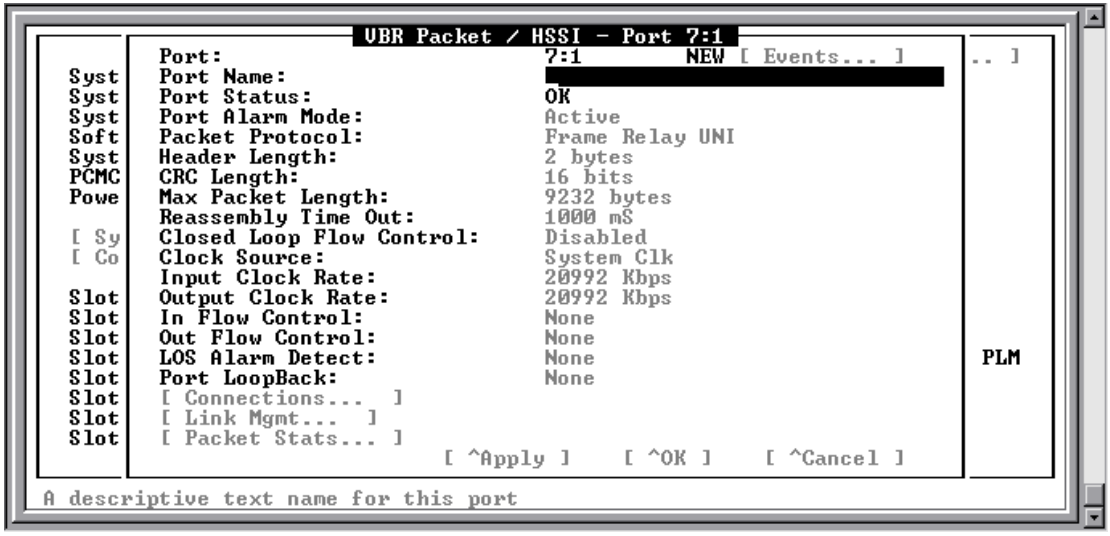

Figure 6.24 - Packet / HSSI Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the packet protocol for the port.** Tab to this field, then press the space bar until the desired selection appears in the field.
4. **Specify the header length for ATM DXI or Frame Relay packets.** If the packet protocol is ATM DXI or Frame Relay UNI, specify the header length of the packets. Tab to the `Header Length` field, then press the space bar to select `2-byte` headers or `4-byte` headers. (This field has no effect on other packet protocols.)
5. Specify the CRC length for error checking. Tab to this field, then press the space bar to select `16-` or `32-bit` error checking.
6. **Specify the maximum packet length.** Tab to this field, then press the space bar until the desired packet length appears in the field.
7. Specify the reassembly time-out period. Tab to this field, then press the space bar to select `100, 200, 500,` or `1000` ms.

8. **Enable or disable closed loop flow control.** Tab to this field, then press the space bar to select `Enabled` (to buffer the data going to the output line), or `Disabled` (to turn off this buffering mode).
9. **Set the clock source.** Tab to this field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock source (System, XClk required) or an external clock received from the attached terminal device (Loop XClk).
10. Specify the input port clock rate. Tab to this field and press `<F2>` or `<Ctrl-P>`. This pops up a list of allowed port clock rates. Use the up and down arrow keys to select the clock rate appropriate for the equipment attached to the port. Press the `<Tab>` key to exit the pop-up.
11. Specify the output port clock rate. Tab to this field and press `<F2>` or `<Ctrl-P>`. This pops up a list of allowed port clock rates. Use the up and down arrow keys to select the clock rate appropriate for the equipment attached to the port. Press the `<Tab>` key to exit the pop-up.
12. **Set the "in" flow control.** Tab to this field, then press the space bar to select the signaling to be used for input (receive) flow control.
13. **Set the "out" flow control.** Tab to this field, then press the space bar to select the signaling to be used for output (transmit) flow control.
14. **Set the LOS detect control.** Tab to this field, then press the space bar to select the signaling to be used for detecting LOS at the port.
15. Make sure loopbacks are set to `None`.
16. Tab to `[^Apply]` and press `<ENTER>`. This applies the configuration changes.
17. Verify the port's connection and configuration. Now look at the port's `Status` field. This field displays `OK` if the port is properly connected to and configured for its attached terminal device.
18. **Turn on the port's alarm reporting.** If the status is `OK`, tab to the `Port Alarm Mode` field and press the space bar to turn the mode to `Active`. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the *CellPath* 300 `System Configuration` screen.

6.18 Packet/DSX-1

Set up the Packet / DSX-1 port by entering the values from the Packet / DSX-1 Port worksheet.

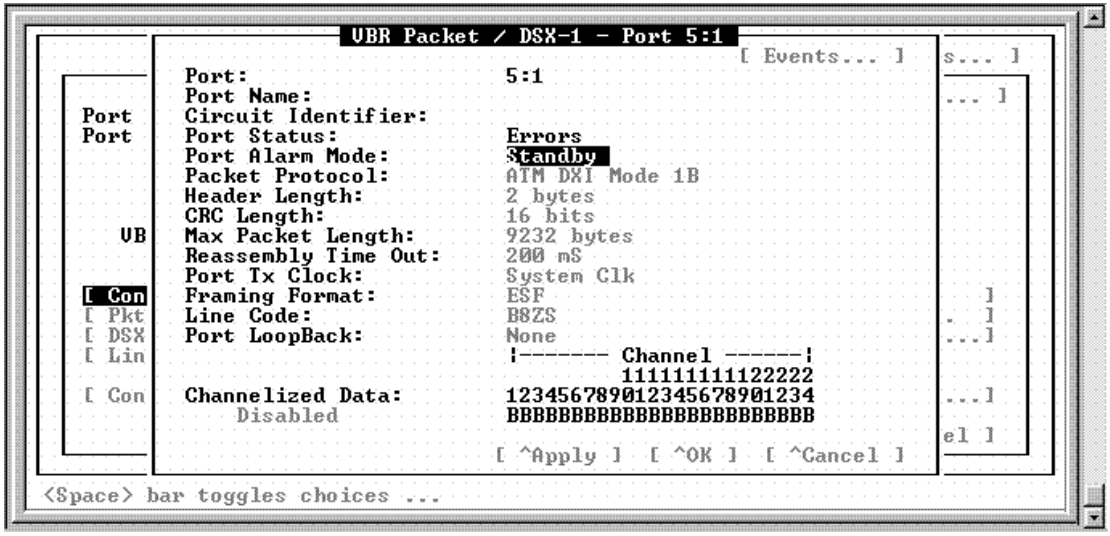

Figure 6.25 - Packet / DSX-1 Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the circuit's identifier number.** Tab to this field, then type in the identifier. The string can be up to 255 alphanumeric characters.
4. **Enter the packet protocol for the port.** Tab to this field, then press the space bar until the desired selection appears in the field.
5. **Specify the header length for ATM DXI or Frame Relay packets.** If the packet protocol is ATM DXI or Frame Relay UNI, specify the header length of the packets. Tab to the `Header Length` field, then press the space bar to select `2-byte` headers or `4-byte` headers. (This field has no effect on other packet protocols.)
6. Specify the CRC length for error checking. Tab to this field, then press the space bar to select `16-` or `32-bit` error checking.
7. **Specify the maximum packet length.** Tab to this field, then press the space bar until the desired packet length appears in the field.

8. **Specify the reassembly time-out period.** Tab to this field, then press the space bar to select `200, 500,` or `1000` ms.
9. **Set the port clock.** Tab to this field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock (System Clk) or the clock recovered from the data stream at the port (Loop Rx). Note: if this port is the source of the system reference clock, the transmit source clock for the port should always be set to the system clock.
10. **Specify the framing format.** Tab to this field, then press the space bar to select extended super frame `(ESF)` or super frame `(SF)`.
11. **Set the line coding.** Tab to this field, then press the space bar to select `B8ZS` or `AMI`.
12. Make sure loopbacks are set to `None`.
13. **Set the type of service.** Select `Nx64` or `Nx56` to enable fractional service. Select `Disabled` to make the entire bandwidth available (fractional service is disabled).
14. Enable or block individual channels. When the channelized data setting is enabled (Nx64 or Nx56), each channel can be toggled between `Enabled (+)` or `Blocked (B)`.
15. Tab to `[^Apply]` and press `<ENTER>`. This applies the configuration changes.
16. Verify the port's connection and configuration. Now look at the port's `Status` field. This field displays `OK` if the port is properly connected to and configured for its attached network or terminal device.
17. **Turn on the port's alarm reporting.** If the status is `OK`, tab to the `Port Alarm Mode` field and press the space bar to turn the mode to `Active`. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the *CellPath* 300 `System Configuration` screen.

6.19 Packet/E1

Set up the Packet/E1 port by entering the values from the Packet/E1 Port worksheet.

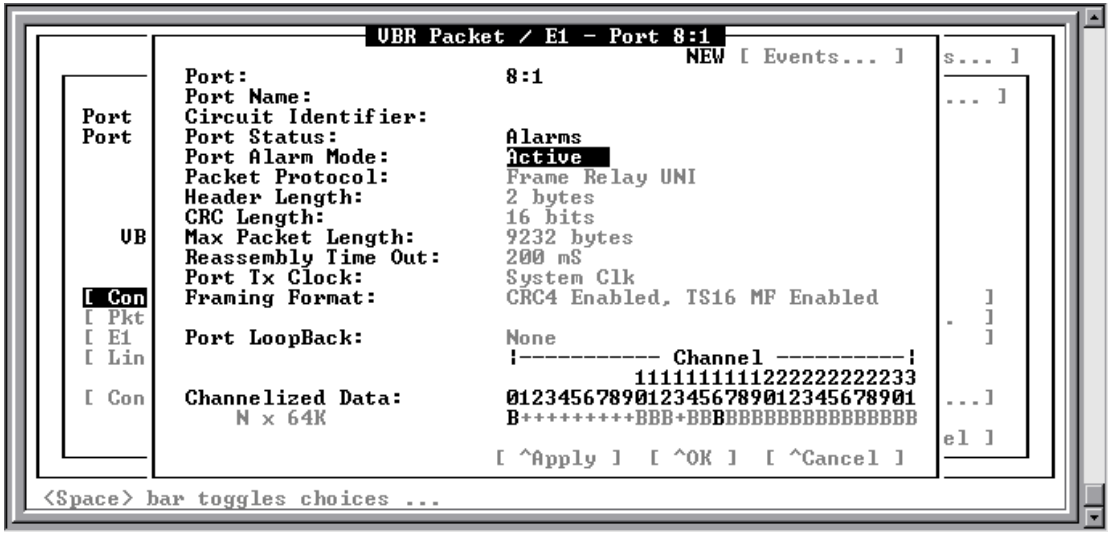

Figure 6.26 - Packet/E1 Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the circuit's identifier number.** Tab to this field, then type in the identifier. The string can be up to 255 alphanumeric characters.
4. **Enter the packet protocol for the port.** Tab to this field, then press the space bar until the desired selection appears in the field.
5. **Specify the header length for ATM DXI or Frame Relay packets.** If the packet protocol is ATM DXI or Frame Relay UNI, specify the header length of the packets. Tab to the `Header Length` field, then press the space bar to select `2-byte` headers or `4-byte` headers. (This field has no effect on other packet protocols.)
6. Specify the CRC length for error checking. Tab to this field, then press the space bar to select `16-` or `32-bit` error checking.
7. **Specify the maximum packet length.** Tab to this field, then press the space bar until the desired packet length appears in the field.

8. Specify the reassembly time-out period. Tab to this field, then press the space bar to select `200, 500,` or `1000` ms.
9. **Set the port clock.** Tab to this field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock (System Clk) or the clock recovered from the data stream at the port (Loop Rx). Note: if this port is the source of the system reference clock, the transmit source clock for the port should always be set to the system clock.
10. **Set framing format.** Toggle through five options to match the framing to the network or terminal equipment connected to this port.
11. Make sure loopbacks are set to `None`.
12. **Set the type of service.** Select `Nx64` to enable fractional service. Select `Disabled` to make the entire bandwidth available (fractional service is disabled).
13. Enable or block individual channels. When the channelized data setting is enabled (Nx64), each channel can be toggled between `Enabled (+)` or `Blocked (B)`.
14. Tab to `[^Apply]` and press `<ENTER>`. This applies the configuration changes.
15. Verify the port's connection and configuration. Now look at the port's `Status` field. This field displays `OK` if the port is properly connected to and configured for its attached network or terminal device.
16. **Turn on the port's alarm reporting.** If the status is `OK`, tab to the `Port Alarm Mode` field and press the space bar to turn the mode to `Active`. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the *CellPath* 300 `System Configuration` screen.

6.20 Packet (10203/10205)/V.35/EIA-530

Set up the Packet / V.35 or EIA-530 port by entering the values from the Packet / V.35 / EIA-530 Port worksheet.

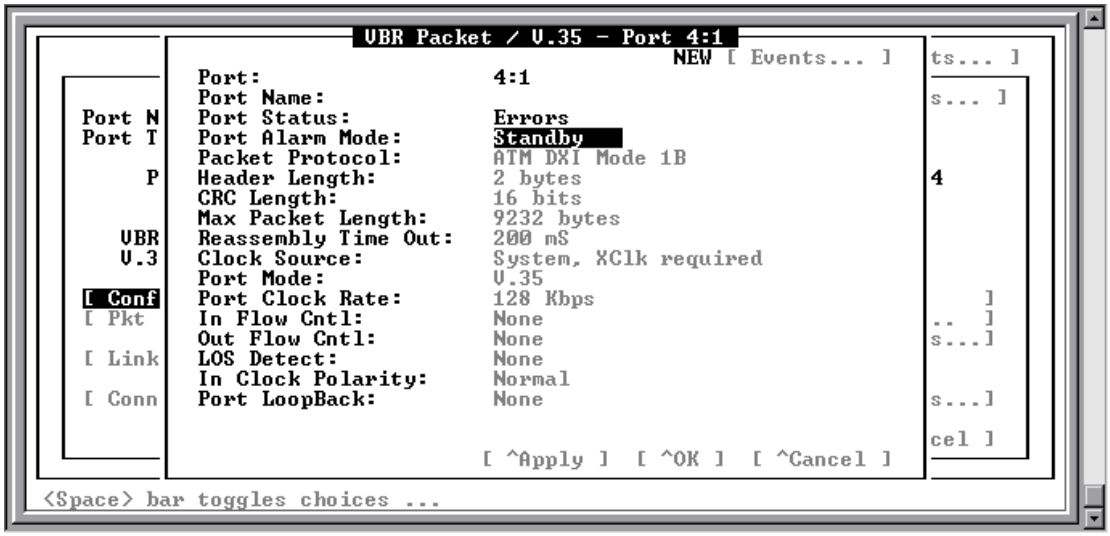

Figure 6.27 - Packet / V.35 / EIA-530 Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the packet protocol for the port.** Tab to this field, then press the space bar until the desired selection appears in the field.
4. **Specify the header length for ATM DXI or Frame Relay packets.** If the packet protocol is ATM DXI or Frame Relay UNI, specify the header length of the packets. Tab to the `Header Length` field, then press the space bar to select `2-byte` headers or `4-byte` headers. (This field has no effect on other packet protocols.)
5. Specify the CRC length for error checking. Tab to this field, then press the space bar to select `16-` or `32-bit` error checking.
6. **Specify the maximum packet length.** Tab to this field, then press the space bar until the desired packet length appears in the field.

7. Specify the reassembly time-out period. Tab to this field, then press the space bar to select `200`, `500`, or `1000` ms.
8. **Set the port clock.** Tab to this field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock source (System, XClk required) or an external clock received from the attached terminal device (Loop Rx). The System Clk, no XClk required option when the *CellPath* 300 is to provide the timing reference for the network or terminal equipment attached to this port can also be used, but the equipment does not supply a synchronized external clock.
9. Set the port mode. Tab to this field, then press the space bar to select `V.35` or `EIA-530`. (Select `EIA-530` for RS449 and X.21.)
10. Specify the port clock rate. Tab to this field and press `<F2>` or `<Ctrl-P>`. This pops up a list of allowed port clock rates. Use the up and down arrow keys to select the clock rate appropriate for the equipment attached to the port. Press the `<Tab>` key to exit the pop-up.
11. **Set the "in" flow control.** Tab to this field, then press the space bar to select the signaling to be used for input (receive) flow control.
12. **Set the "out" flow control.** Tab to this field, then press the space bar to select the signaling to be used for output (transmit) flow control.
13. **Set the LOS detect control.** Tab to this field, then press the space bar to select the signaling to be used for detecting LOS at the port.
14. **Set the polarity of the receive clock.** Tab to this field, then press the space bar to select `Normal`; or select `Inverted` to invert the clock if experiencing problems with errored data.
15. Make sure loopbacks are set to `None`.
16. Tab to `[^Apply]` and press `<ENTER>`. This applies the configuration changes.
17. Verify the port's connection and configuration. Now look at the port's `Status` field. This field displays `OK` if the port is properly connected to and configured for its attached terminal device.
18. **Turn on the port's alarm reporting.** If the status is `OK`, tab to the `Port Alarm Mode` field and press the space bar to turn the mode to `Active`. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the *CellPath* 300 `System Configuration` screen.

6.21 CBR/DSX-1

Set up the CBR / DSX-1 port by entering the values from the CBR / DSX-1 Port worksheet.

Figure 6.28 - CBR / DSX-1 Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the circuit's identifier number.** Tab to this field, then type in the identifier. The string can be up to 255 alphanumeric characters.
4. **Specify the maximum buffer depth for this port.** Tab to this field, then press the space bar until the desired selection appears in the field.
5. Set the port clock to System Clk. CBR / DSX-1 ports always transmit data using the *CellPath* 300 system clock.

NOTE

The equipment attached to the port must be capable of synchronizing to an external timing source or must incorporate a slip buffer to handle transmission-rate mismatches.

6. **Specify the framing format.** Tab to this field, then press the space bar to select extended super frame (ESF) or super frame (SF).
7. **Specify the line coding.** Tab to this field, then press the space bar to select B8ZS or AMI.
8. **Specify the behavior on LOS Detect.** Select Gen All 1s Cells (to send an alarm indication signal (an all-ones signal) in response to a loss of signal) or Gen No Cells (to preserve bandwidth by preventing the transmission of any cells).
9. Make sure loopbacks are set to None.
10. **Set the type of service.** Select Nx64 or Nx56 to enable fractional service. Select Disabled to make the entire bandwidth available (fractional service is disabled).
11. Enable or block individual channels. When the channelized data setting is enabled (Nx64 or Nx56), each channel can be toggled between Enabled (+) or Blocked (B).
12. Tab to [^Apply] and press <ENTER>. This applies the configuration changes.
13. Verify the port's connection and configuration. Now look at the port's Status field. This field displays OK if the port is properly connected to and configured for its attached terminal device.

CBR ports display an Errors status if a connection to the port has been established and no data transmission is occurring. This situation generates a FIFO underflow condition at the port.

14. **Turn on the port's alarm reporting.** If the status is OK, tab to the Port Alarm Mode field and press the space bar to turn the mode to Active. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to [^OK] and press <ENTER>. This applies the entered values and returns to the *CellPath* 300 System Configuration screen.

6.22 CBR/E1

Set up the CBR/E1 port by entering the values from the CBR/E1 Port worksheet.

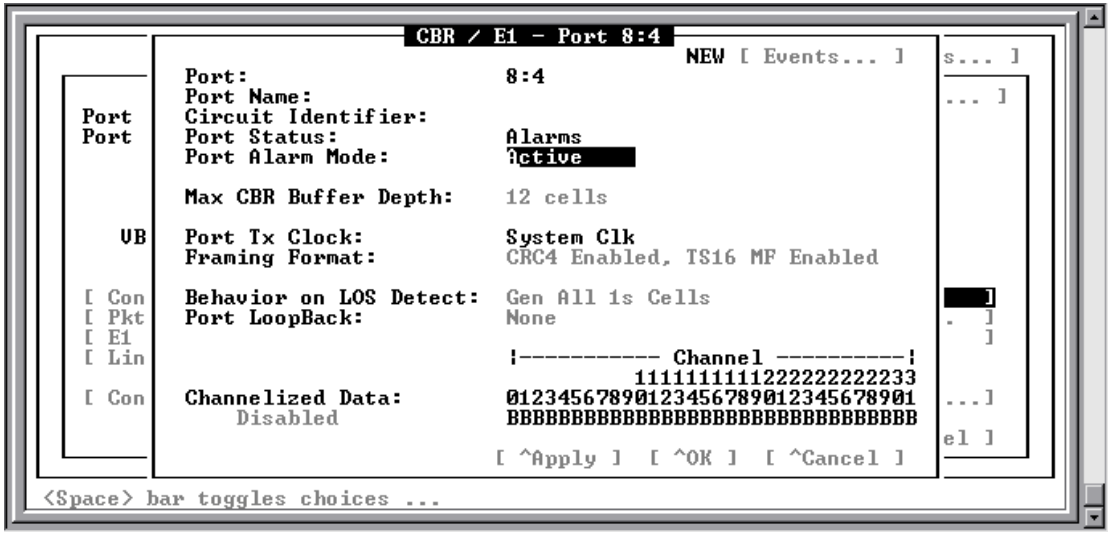

Figure 6.29 - CBR/E1 Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Enter the circuit's identifier number.** Tab to this field, then type in the identifier. The string can be up to 255 alphanumeric characters.
4. **Specify the maximum buffer depth for this port.** Tab to this field, then press the space bar until the desired selection appears in the field.
5. Set the port clock to `System Clk`. CBR/E1 ports always transmit data using the *CellPath* 300 system clock.

The equipment attached to the port must be capable of synchronizing to an external timing source or must incorporate a slip buffer to handle transmission-rate mismatches.

6. **Set framing format.** Toggle through five options to match the framing to the network or terminal equipment connected to this port.
7. **Specify the behavior on LOS Detect.** Select `Gen All 1s Cells` (to send an alarm indication signal (an all-ones signal) in response to a loss of signal) or `Gen No Cells` (to preserve bandwidth by preventing the transmission of any cells).
8. Make sure loopbacks are set to `None`.
9. **Set the type of service.** Select `Nx64` to enable fractional service. Select `Disabled` to make the entire bandwidth available (fractional service is disabled).
10. Enable or block individual channels. When the channelized data setting is enabled (Nx64), each channel can be toggled between `Enabled (+)` or `Blocked (B)`.

    Tab to `[^Apply]` and press `<ENTER>`. This applies the configuration changes.
11. Verify the port's connection and configuration. Now look at the port's `Status` field. This field displays `OK` if the port is properly connected to and configured for its attached terminal device.

CBR ports display an `Errors` status if a connection to the port has been established and no data transmission is occurring. This situation generates a FIFO underflow condition at the port.

12. **Turn on the port's alarm reporting.** If the status is `OK`, tab to the `Port Alarm Mode` field and press the space bar to turn the mode to `Active`. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the *CellPath* 300 `System Configuration` screen.

6.23 CBR/V.35/EIA-530

Set up the CBR/V.35/EIA-530 port by entering the values from the CBR/V.35/EIA-530 Port worksheet.

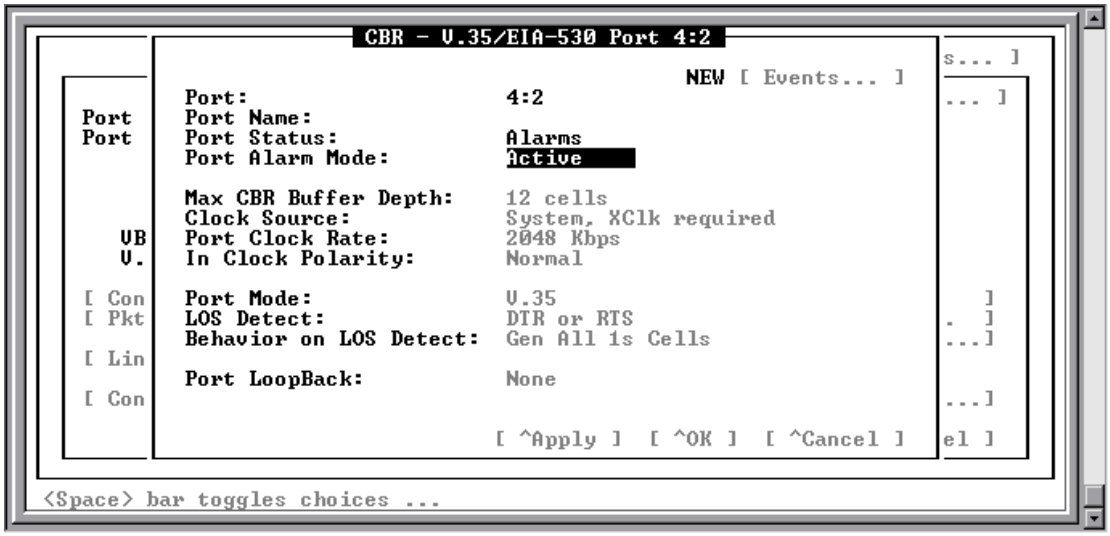

Figure 6.30 - CBR/V.35/EIA-530 Screen

1. **Port.** This is a read-only field. It identifies the port location in the chassis. The format is *slot:port*.
2. **Enter the port name.** Enter the name for the port here or in the `System Administration` screen. The string can be up to 31 characters.
3. **Specify the maximum buffer depth for this port.** Tab to this field, then press the space bar until the desired selection appears in the field.
4. **Set the port clock.** Tab to this field, then press the space bar to select the clock source to use for timing data transmission. Reference the *CellPath* 300 system clock source (System Clk, XClk required) or an external clock received from the attached terminal device (Loop Rx). The `System Clk, no XClk required` option when the *CellPath* 300 is to provide the timing reference for the network or terminal equipment attached to this port can be used, but the equipment does not supply a synchronized external clock.

5. **Specify the port clock rate.** Tab to this field and press <F2> or <Ctrl-P>. This pops up a list of allowed port clock rates. Use the up and down arrow keys to select the clock rate appropriate for the equipment attached to the port. Press the <Tab> key to exit the pop-up.
6. **Set the polarity of the receive clock.** Use this option when experiencing problems with errored data. Inverting the clock changes the effective timing relationship between the clock and the data, and may correct for a skew caused by transmission delay through a long cable.
7. **Set the port mode.** Tab to this field, then press the space bar to select V.35 or EIA-530.

CAUTION

Leaving unterminated cables attached to an EIA-530 CBR port can cause ringing on the clock signal lines, resulting in a higher clocking rate than intended. This can interfere with data transmission through other CBR ports in the same slot. Always make sure that the cables are properly terminated or remove them from the port connector.

8. **Set the LOS detect control.** Tab to this field, then press the space bar to select the signaling to be used for detecting LOS at the port.
9. **Specify the behavior on LOS Detect.** Select Gen All 1s Cells to send an alarm indication signal (an all-ones signal) in response to a loss of signal or Gen No Cells to preserve bandwidth by preventing the transmission of any cells.
10. Make sure loopbacks are set to None.
11. Tab to [^Apply] and press <ENTER>. This applies the configuration changes.
12. **Verify the port's connection and configuration**. Now look at the port's Status field. This field displays OK if the port is properly connected to and configured for its attached terminal device.

CBR ports display an Errors status if a connection to the port has been established and no data transmission is occurring. This situation generates a FIFO underflow condition at the port.

13. **Turn on the port's alarm reporting.** If the status is `OK`, tab to the `Port Alarm Mode` field and press the space bar to turn the mode to `Active`. This turns on alarm reporting for the port.

When the port configuration parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the *CellPath* 300 `System Configuration` screen.

CHAPTER 7 Configuring for Remote Access

This chapter steps through the minimum steps needed to configure a *CellPath* 300 unit as an IP host on a TCP/IP network. Once these steps are complete, the *CellPath* 300 can be remotely accessed via Ethernet or in-band SNMP.

If multiple *CellPath* 300 units are being setup in the network, or if setting up a *CellPath* 300 unit to be managed by multiple management stations, refer to the *CellPath 300 ATM WAN Multiplexer Configuration Manual*. The configuration manual provides background information about setting up multiple network management connections, which is not covered in this manual.

This chapter assumes that all the necessary cables have been connected. For example, if the *CellPath* 300 is on an Ethernet LAN, it is assumed that the optional PCMCIA Ethernet card has been installed. Instructions on connecting cables are detailed in Chapter 3.

This chapter covers the following topics:

7.1 Configuring the PCMCIA Ethernet Interface

Set up the PCMCIA Ethernet interface by entering the values from the *CellPath* 300 Remote Access worksheet.

Selecting the `[SNMP & TCP/IP...]` button in the `System Configuration` screen (Figure 7.1) accesses the `SNMP & TCP/IP Management` screen (Figure 7.2).

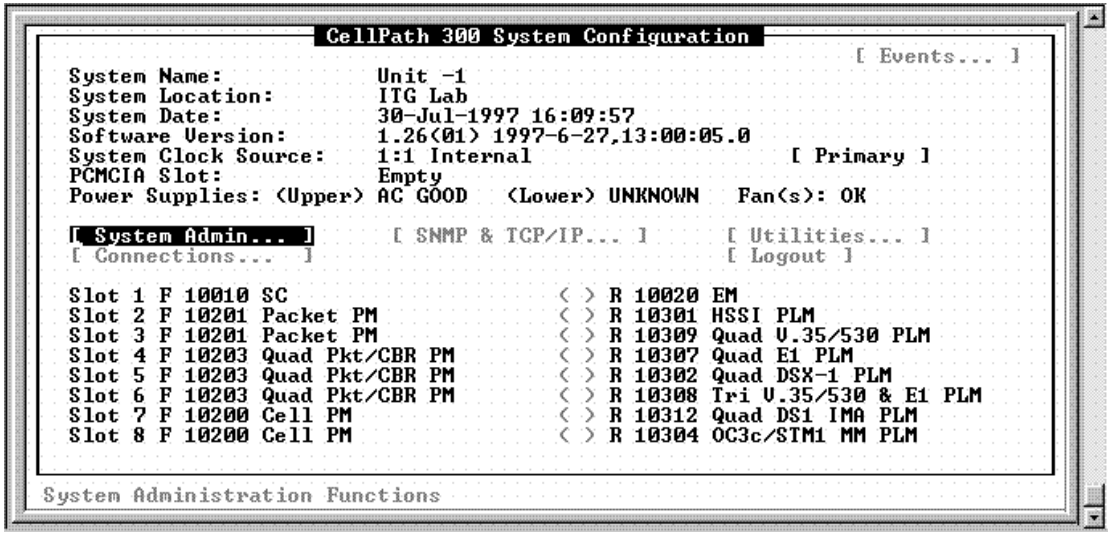

Figure 7.1 - System Configuration Screen

Tab to the [Add New Interface] button and press <ENTER>. The Add New IP Interface screen (Figure 7.3) is displayed.

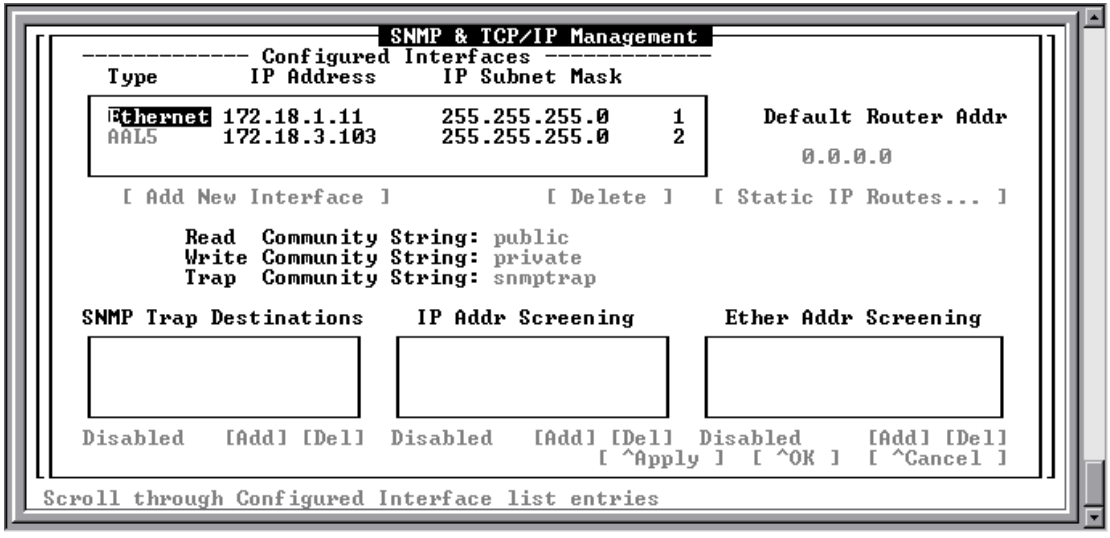

Figure 7.2 - SNMP & TCP/IP Management Screen

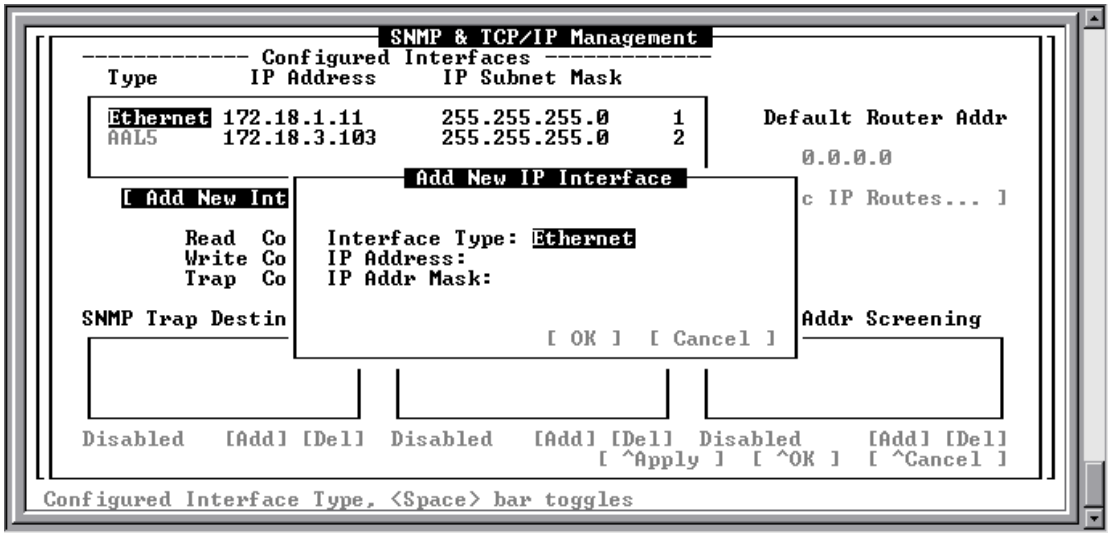

Figure 7.3 - Add New IP Interface Screen

Enter the values from the worksheet into the pop-up.

1. **Set the Interface type to Ethernet**. Press the space bar until Ethernet appears in the field.
2. **Specify the IP address for the Ethernet interface.** Tab to this field and enter the IP address (in dotted-decimal format).
3. **Specify the IP netmask for the Ethernet interface.** Tab to this field and enter the IP netmask (in dotted-decimal format).

When the Ethernet parameters have been entered, tab to the `[^OK]` button and press the `<ENTER>` key. This applies the entered values and returns to the `SNMP & TCP/IP Management` screen (Figure 7.2).

The scrolling list displayed under `Configured Interfaces` should reflect the newly-entered values.

7.2 Configuring an In-band IP over ATM Interface

The *CellPath* 300 has the ability to establish an in-band IP over ATM connection between the System Controller and an IP host. This allows remote access to the *CellPath* 300 with no additional hardware.

There are two steps to setting up an in-band IP over ATM interface. First, create the IP interface. Then configure an ATM connection from the *CellPath* 300 System Controller to the IP host.

7.2.1 Creating the IP Interface

In the `System Configuration` screen (Figure 7.1), tab to the `[SNMP & TCP/IP...]` button and press `<ENTER>`. This brings up the `SNMP & TCP/IP Management` screen (Figure 7.2).

Tab to `[Add New Interface]` and press `<ENTER>`. The `Add New IP Interface` screen (Figure 7.3) is displayed.

Enter the worksheet values into the pop-up.

1. **Set the interface type to AAL5**. Press the space bar until AAL5 appears in the field.
2. **Specify the IP address for the AAL5 interface.** Tab to this field and enter the IP address (in dotted-decimal format).
3. **Specify the IP netmask for the AAL5 interface.** Tab to this field and enter the IP netmask (in dotted-decimal format).

When the AAL5 parameters have been entered, tab to `[^OK]` and press `<ENTER>`. This applies the entered values and returns to the `SNMP & TCP/IP Management` screen (Figure 7.2).

The scrolling list displayed under `Configured Interfaces` should reflect the newly-entered values.

7.2.2 Configuring the Connection

Now, configure the ATM connection from the *CellPath* 300 System Controller to the IP host. The IP host must be on the same subnet as the AAL5 interface just configured.

Exit the `SNMP & TCP/IP Management` screen by tabbing to `[^OK]` and pressing <ENTER>. This returns to the *CellPath* 300 `System Configuration` screen (Figure 7.1). Tab to the physical layer module that contains the port through which the remote IP host is connected. Press `<ENTER>` to access the configuration screen for that port.

From the port configuration screen, tab to `[Connections...]` and press `<ENTER>`. This brings up the port's `Connections` screen (Figure 7.4).

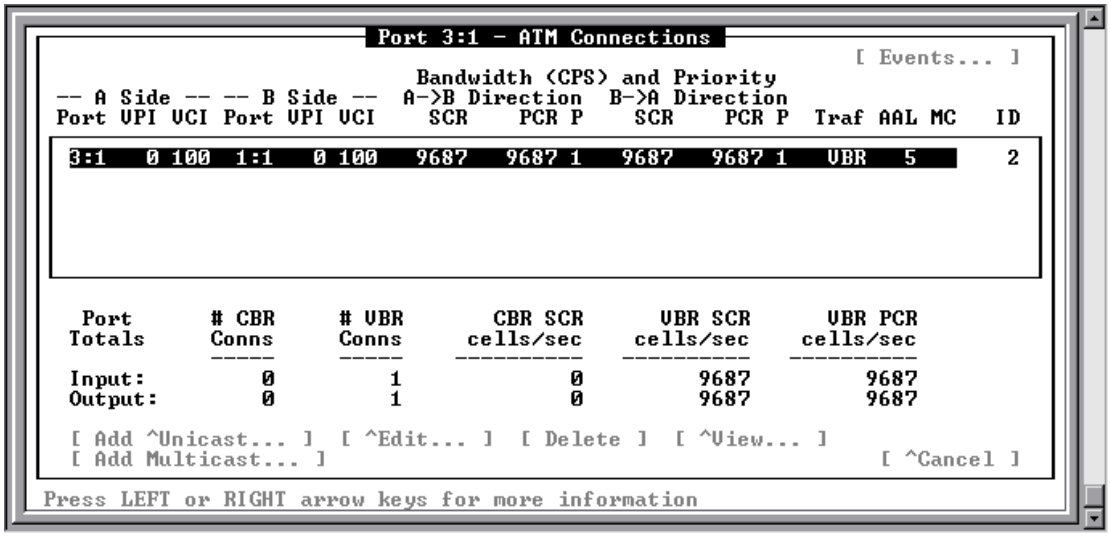

Figure 7.4 - Port Connections Screen

In the Port Connections screen, tab to [^Add Unicast] and press <ENTER>. The Add New ATM Unicast Connection screen (Figure 7.5) for the port is displayed.

Enter the worksheet values into the Add New ATM Unicast Connection screen.

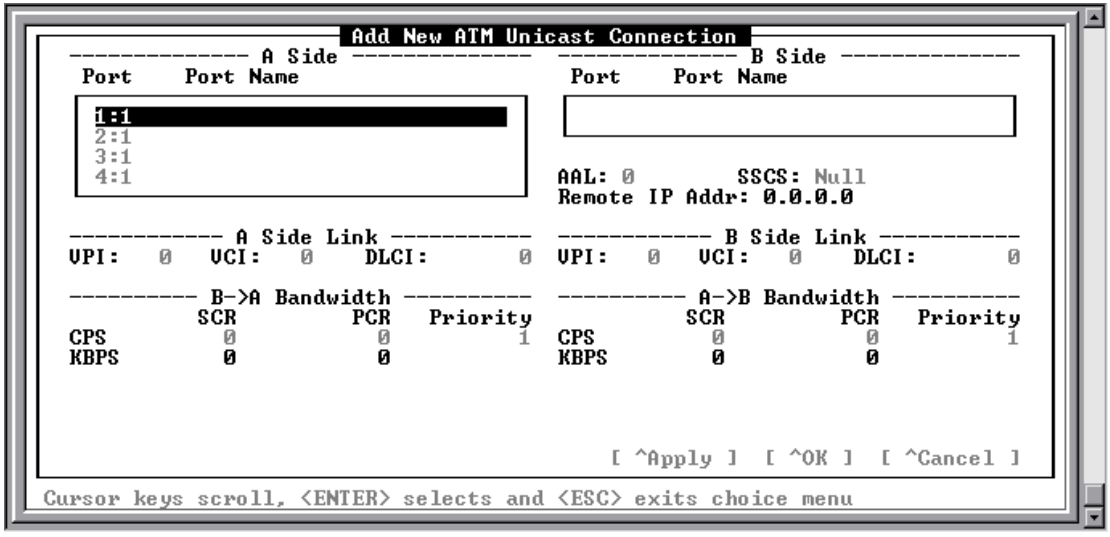

Figure 7.5 - Add New ATM Unicast Connection Screen

1. **Enter the port number of the System Controller module (1:1)**. When this screen comes up, side A has an active pop-up. Select the value 1:1, then press the <Tab> key to exit the pop-up.
2. Specify the port through which the IP connection to the remote host is being made. Tab to side B and a pop-up appears. Use the up and down arrow keys to move to the correct port selection. Press the <Tab> key to exit the pop-up.
3. **Set connection, traffic, and AAL type.** Each of these entries has to be set to a certain value for an in-band IP over ATM connection. Connection must be VCC, Traffic must be VBR, and AAL must be 5. Tab to each field and use the space bar to make the selections.
4. **Enter the SSCS.** Set the SSCS to the value specified on the worksheet. Use the space bar to toggle through the values until the appropriate one is displayed. Do not set this field to Unknown.
5. **Enter the connection encapsulation.** Use the space bar to toggle through the options. This entry cannot be left as Null. When the proper value is displayed, press the <Tab> key.

NOTE

Encapsulation nomenclature used by the router vendor may be different than that used for the *CellPath* 300. Refer to the *CellPath* 300 *ATM WAN Multiplexer Configuration Manual* for definitions of the encapsulation types used by the *CellPath* 300.

6. **Enter the remote host's IP address.** Enter the value of the remote IP host in dotted-decimal format.
7. **Enter the local and remote VPI/VCIs**. Enter the VPI/VCI values for the *CellPath* 300. Enter the numbers and then press the <Tab> key to move to the next field. After the local VPI/VCIs have been entered, enter the VPI/VCI for the remote ATM node. If the connection is a Frame Relay UNI connection, enter the DLCI values, the *CellPath* 300 maps them to VPI/VCI values. Press the <Tab> key when the proper values have been entered.
8. **Enter the sustainable cell rate, peak cell rate, and priority for the local-to-remote direction and the remote-to-local direction.**

   With the cursor under the SCR cell/sec field, press <F2> or <Ctrl-P> to get the list of possible cell rates. If the bandwidth for the connection is known, use the general guideline of 173 cells-per-second for each 64 Kbits of bandwidth. If the bandwidth for the connection is not known, set the bandwidth to a value of approximately 4500 cells-per-second. This low cell rate is adequate to establish remote access to the unit. The cell rate can be increased or decreased later when experience has been gained regarding the amount of SNMP traffic being transmitted through the connection. Press <ENTER> when the value is selected.

   Once the SCR value is set, the PCR cell/sec is automatically set to the same amount. This is typically appropriate for network management connections, but can be increased. The SCR and PCR values are displayed both in cells-per-second and kilobits-per-second.

   Set the priority to 1 if network management connections are to be the most important, or 4 if least important.

   Repeat the above actions for the remote-to-local direction.
9. This feature specifies the Frame Relay frame header bit mappings to ATM cell header bit mappings and chooses Transparent or Translation Mode.

Tab to [^OK] and press <ENTER>. This returns to the Port Connections screen (Figure 7.4).

Tab to [^OK] in the Port Configuration screen and press <ENTER>. This returns to the System Configuration screen (Figure 7.1).

7.3 Setting the Default Router

Always set up a default router for the *CellPath* 300 if planning to access the unit from a host whose IP address is on a different subnet than that of the configured *CellPath* 300. When accessed by a host on a different subnet, the *CellPath* 300 sends responses to the default router. The default router routes the responses to the appropriate subnets. The default router must be on the same subnet as the configured *CellPath* 300.

In the `System Configuration` screen (Figure 7.1), tab to the `[SNMP & TCP/IP...]` button and press `<ENTER>`. This brings up the `SNMP & TCP/IP Management` screen (Figure 7.2).

Enter the address of the default router in the `Default Router Addr` field. Press the `<Tab>` key to exit the field. This causes the IP address to be validated. If there is an error, the cursor is returned to the field and an error message is displayed. The value in this field does not take effect until either the `[^OK]` or `[^Apply]` button is selected.

7.4 Viewing and Adding Static IP Routes

The *CellPath* 300 allows static routes to be specified to be used in directing traffic back to a management station.

7.4.1 Adding a Static IP Route

In the `System Configuration` screen (Figure 7.1), tab to the `[SNMP & TCP/IP...]` button and press `<ENTER>`. This brings up the `SNMP & TCP/IP Management` screen (Figure 7.2).

Tab to `[Static IP Routes...]` and press `<ENTER>`. The `Static IP Route Management` screen (Figure 7.6) is displayed. Tab to `[Add New Static IP Route...]`, and press the `<ENTER>` key. The `Add New IP Static Route` screen (Figure 7.7) is displayed.

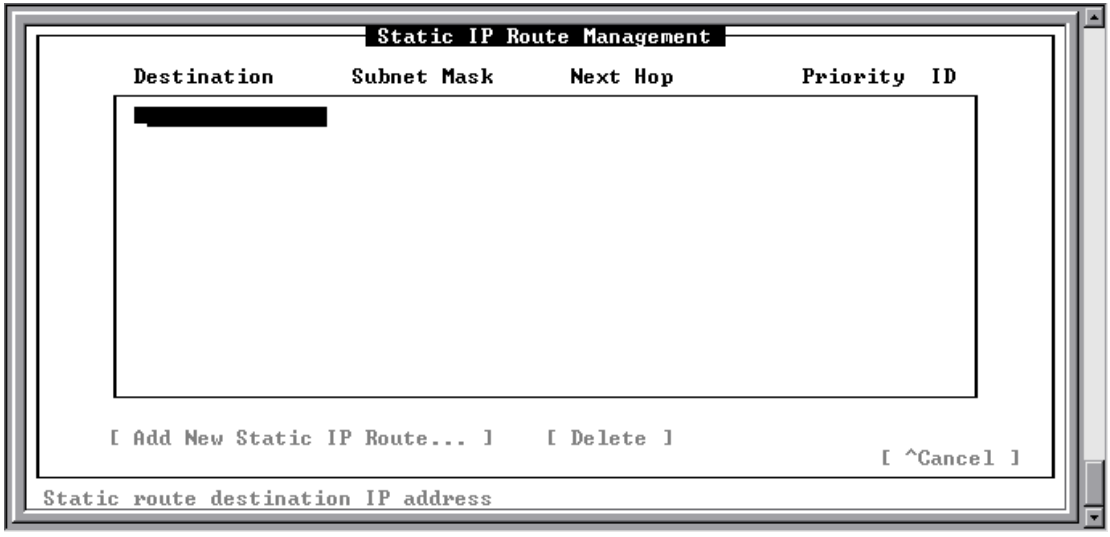

Figure 7.6 - Static IP Route Management Screen

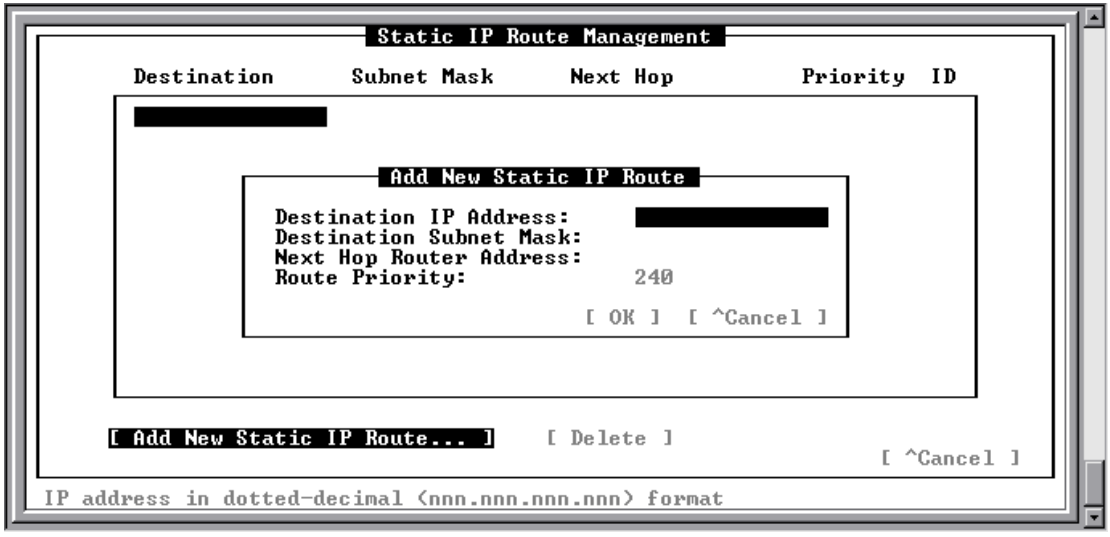

Figure 7.7 - Add New Static IP Route Screen

1. **Specify a destination IP address**. When leaving this field, the new address is automatically added.
2. **Specify a destination subnet mask**. If a legal IP address has been entered, a default value is added for the subnet mask field. This value can be edited.
3. **Specify the next hop router address**. This must be on the same network as one of the currently-configured IP interfaces in the *CellPath* 300.
4. **Specify a Route Priority in the range 1-255**. The same priority for two routes to the same destination cannot be used.

   When all the values are entered, press [^OK] to save the new route and exit the pop-up. A total of 16 static routes can be configured.

7.5 Adding a Host to the SNMP Trap Destinations List

If the *CellPath* 300 is to send its traps to a remote IP host, the address of that host needs to be entered in the *CellPath* 300 SNMP trap destination list. Up to ten host addresses can be entered. The hosts must be on the same subnet as the *CellPath* 300 or be accessible via the default router.

In the System Configuration screen (Figure 7.1), tab to the [SNMP & TCP/IP...] button and press <ENTER>. This brings up the SNMP & TCP/IP Management screen (Figure 7.2).

In the SNMP & TCP/IP Management screen, tab to the [Add] button under the SNMP Trap Destinations section and press <ENTER>. The Enter an IP Address screen (Figure 7.8) is displayed.

In the resultant pop-up, enter the IP address (in dotted-decimal format) of the IP host the *CellPath* 300 is to send traps to. Then tab to [^OK] and press <ENTER>.

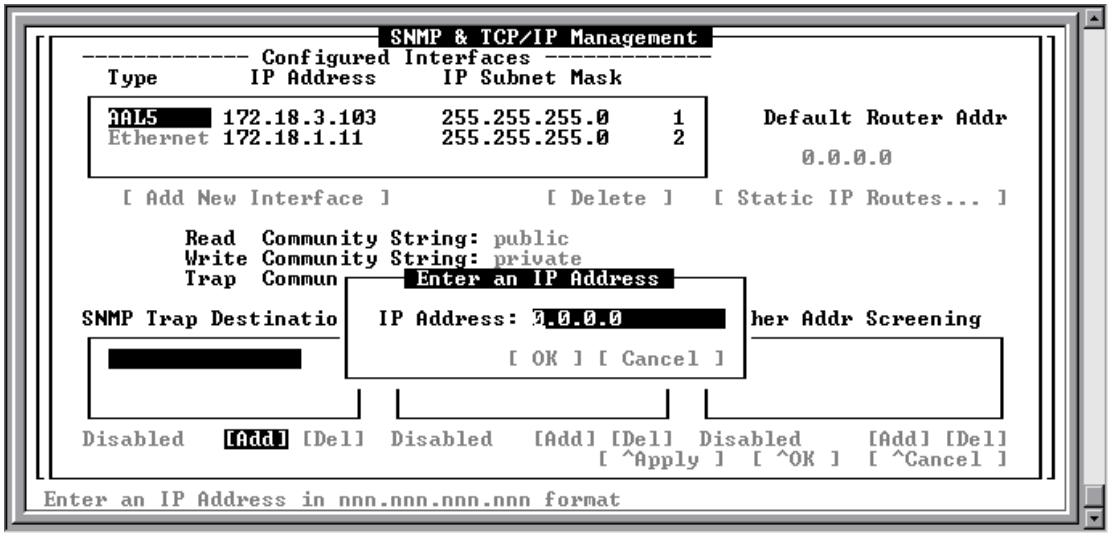

Figure 7.8 - Enter IP Address Screen

Repeat the previous steps to enter additional host addresses.

When all the host addresses have been entered, tab to the [^OK] button and press <ENTER>. The SNMP Trap Destinations scrolling list should display the new trap host.

7.6 Enabling SNMP Traps

In addition to setting up the SNMP trap destination addresses, as described on the previous page, SNMP traps in the *CellPath* 300 need to be enabled.

In the System Configuration screen (Figure 7.1), tab to the [SNMP & TCP/IP...] button and press <ENTER>. This brings up the SNMP & TCP/IP Management screen (Figure 7.2).

In the SNMP & TCP/IP Management screen, tab to the Disabled field under SNMP Trap Destinations and press the space bar. The field changes to Enabled.

Changes to this field do not take effect until the [^OK] or [^Apply] button is pressed.

APPENDIX A Specifications

A.1 *CellPath* 300 Chassis

Table A.1 provides specifications relevant to the *CellPath* 300 chassis. When installing the *CellPath* 300, adhere to the below listed environmental, safety and power requirements.

Table A.1 - *CellPath* 300 Chassis

Parameter	Specification
Physical	Width: 17.32 in. (44.0 cm) 18.96 in (48.16 cm) with standard rack ears 22.96 in (58.32 cm) with optional rack extension Depth: 19 in. (28.26 cm) - 3 in. (7.62 cm) rear clearance Height: 13.95 in. (35.43 cm), including feet Weight: 60 lbs (27 kg), fully loaded
Mounting brackets	Available for 19-in. or 23-in. standard equipment racks
Environmental	
Storage	-20°C to 66°C (5% to 95% RH, non-condensing)
Operating	0°C to 40°C ambient (5% to 95% RH, non-condensing)
EMI/ESD/Safety	
EMI	FCC Part 15, Class A, EN55022 Class B
ESD	EN50082-1
Safety	UL1950, EN60950, CSA 22.2 No. 950
Switching backplane	
Type	Time-multiplexed cell bus, output buffered per port
Maximum system throughput	524 Mbps (1,168,000 cells / second)
Virtual channel connections (VCCs)	8192

Table A.1 - *CellPath* 300 Chassis

Parameter	Specification
Virtual path connections (VPCs)	512
Multicast connections	512
Power system	
Description	Dual redundant power system Modular power supplies, hot-swappable Monitored with alarms / traps on failure Forced-air cooled (power supply fans not monitored) Supports mixed use of AC / DC power modules
AC power supply modules	120 VAC rating - 100 to 132 volts AC, 57 to 60Hz 240 VAC rating - 190 to 264 volts AC, 47 to 53 Hz
DC power supply modules	42 to 60 volts DC
Power interruptions	Loss of all input line power for any length of time does not affect configuration settings. Typically data is maintained upon loss of power for 12 hours.
Cooling system	
Description	Dual fans mounted in field-replaceable tray monitored for RPM with alarms for single or double failure. May be replaced with system powered.

A.2 System Controller/Extension Module

Table A.2 provides specifications relevant to the *CellPath* 300 System Controller (SC) and Extension Module (EM).

CAUTION

It is necessary to power down the *CellPath* 300 before removing either the System Controller or Extension module.

Table A.2 - System Controller and Extension Module

Parameter	Specification
System clocking	
Clock sources	Internal reference oscillator, or Recovered from user-specified physical port
Clock fallback	User-selectable primary and secondary clock source with automatic fallback and recovery
Internal reference oscillator	Stratum 4 or better
System management	
User Interface	Character-based forms (VT100 terminal) accessible via front panel comm port, Telnet over Ethernet, and Telnet over in-band AAL5 ATM connections.
SNMP Management	SNMP Version 1.0
Standard MIBs	RFC 1155, RFC 1212, RFC 1213 (MIB II), RFC 1406 (DS1/E1), RFC 1407 (DS3/E3)
Enterprise MIB	Enterprise MIB supporting all *CellPath* 300 configurable items with the exception of passwords and community strings.
Management access	

Table A.2 - System Controller and Extension Module

Parameter	Specification
Configuration comm port	One (on front panel) Type: DCE Connector: 9-pin RS232 EIA / TIA-574 Baud rates: 2400, 9600, 19200, and 38400 Parity: None, Even, Odd Data bits: 7,8 Stop bits: 1,2 Handshakes: None, DTR & RTS required Terminal type: VT100, or Sun shell tool emulating VT100
Ethernet port	One (optional). Supports only remote management over an Ethernet LAN. Type: PCMCIA card 10BaseT Support protocols: TCP / IP for SNMP access to MIBs; Telnet access to user interface and ICMP Echo
In-band over ATM connection	Supported protocols: TCP / IP for SNMP access to MIBs; Telnet access to user interface and ICMP Echo Supported encapsulations: Null, LLC / SNAP, NLPID, EtherType

A.3 Supported Protocol and Physical Layer Modules

Table A.3 lists the supported Protocol Modules (PMs) and the Physical Layer Modules (PLMs) supported by each.

Table A.3 - Protocol to Physical Layer Module Pairings

Protocol Module	Physical Layer Module
10200 Cell	10300 DS3 10304 OC-3c / STM1 MM 10305 OC-3c / STM1 SM 10306 E3 10310 J2 10312 IMA DS1 10313 IMA E1
10201 Packet	10300 DS3 10301 HSSI 10306 E3 10309 Quad V.35 / EIA-530 10310 J2
10202 Quad Cell	10302 Quad DSX-1 10307 Quad E1
10203 Quad Packet / CBR	10302 Quad DSX-1 10303 Tri V.35 / EIA-530 & DSX-1 10307 Quad E1 10308 Tri V.35 / EIA-530 & E1 10309 Quad V.35 / EIA-530
10205 Quad Packet	10302 Quad DSX-1 10303 Tri V.35 / EIA-530 & DSX-1 10307 Quad E1 10308 Tri V.35 / EIA-530 & E1 10309 Quad V.35 / EIA-530

Table A.4 lists the supported Physical Layer Modules (PLMs) and the respective Protocol Modules (PM) that supports it.

Table A.4 - Physical Layer to Protocol Module Pairings

Physical Layer Module	Protocol Module
10300 DS3	10200 Cell 10201 Packet
10301 HSSI	10201 Packet
10302 Quad DSX-1	10202 Quad Cell 10203 Quad Packet / CBR 10205 Quad Packet
10303 Tri V.35 / EIA-530 & DSX-1	10203 Quad Packet / CBR 10205 Quad Packet
10304 OC-3c / STM1 MM	10200 Cell
10305 OC-3c / STM1 SM	10200 Cell
10306 E3	10200 Cell 10201 Packet
10307 Quad E1	10202 Quad Cell 10203 Quad Packet / CBR 10205 Quad Packet
10308 Tri V.35 / EIA-530 & E1	10203 Quad Packet / CBR 10205 Quad Packet
10309 Quad V.35 / EIA-530	10201 Packet 10203 Quad Packet / CBR 10205 Quad Packet
10310 J2	10200 Cell 10201 Packet
10312 IMA DS1	10200 Cell
10313 IMA E1	10200 Cell

A.4 *CellPath* 300 Protocol Modules (PMs)

Tables A5 through A.11 contains the specifications of each of the supported *CellPath* 300 Protocol Modules (PMs).

Table A.5 - 10200 Cell PM

Parameter	Specification
General	
Supported PLMs	10300 DS3 10304 OC-3c / STM1 MM 10305 OC-3c / STM1 SM 10306 E3 10310 J2 10311 IMA DS1 10312 IMA E1
Processing capacity	ATM UNI: ≤155 Mbps
Interface types supported	ATM UNI (for network or user ports)
Traffic types handled	CBR and VBR
Connections	
Number of virtual connections per port	ATM UNI Mode: Up to 255 virtual path connections (VPCs) or 4096 virtual channel connections (VCCs) or combinations thereof up to 4096 total connections SNI Mode: One virtual connection with MID multiplexing capability
Traffic and congestion management	
General	Congestion management algorithm with partial packet and early packet discarding and 4 VBR priorities CBR not subject to congestion
Input queuing	Non-blocking separate CBR and VBR input queues
Output queuing	Separate CBR and VBR output queues, with traffic and congestion management capability

Table A.5 - 10200 Cell PM

Parameter	Specification
Rate control	PCR and SCR rate control / UPC for CLP 0+1, per virtual connection
Maximum burst size / tolerance	32, 105, 210, or maximum cells
Cell emission scheduling for minimal CDV	Per virtual connection for CBR Per input port for VBR
Maximum CDV (CBR only)	Equals one emission time of the corresponding connection / port (e.g., 10 µs for a 45 Mbps connection / port) with an absolute max. of 250 µs
Statistics collection	
Statistics collected per port	Number of valid cells Number of cells discarded for HEC errors Number of cells discarded for PCR violation Number of cells discarded for congestion Number of cells discarded for invalid connection identification
Standards Compliance (Meets applicable requirements of the following standards / generic requirements):	
ATM Forum UNI Version 3.1, September 1994 "User-Network Interface Specifications"	
Bellcore GR-2848-CORE, June 1994, "Broadband Multi-service User-Network Interface Generic Requirements"	
Bellcore TR-TSV-000772, May 1991, "Generic Requirements in Support of Switched Multi-Megabit Data Service"	
Bellcore GR-1113-CORE, July 1994, "Asynchronous Transfer Mode (ATM) and ATM Adaptation Layer (AAL) Protocols Generic Requirements"	
Bellcore GR-2842-CORE, November 1994, "ATM Service Access Multiplexer (SAM) Generic Requirements"	
Bellcore TA-NWT-001110, August 1992, "Broadband ISDN Switching System Generic Requirements"	
ITU-T Recommendation I.413, "Broadband ISDN User-Network Interface"	
ITU-T Recommendation I.311, "Broadband ISDN General Aspects"	
ITU-T Recommendation I.150, "Asynchronous Transfer Mode Functional Characteristic"	
ITU-T Recommendation I.361, "Broadband ISDN ATM Layer Specification"	

Table A.5 - 10200 Cell PM

Parameter	Specification
ITU-T Recommendation I.363, “Broadband ISDN Adaptation Layer Specification”	
ITU-T Recommendation I.371, “Traffic Control and Congestion Control in B-ISDN”	

A.4.1 10201 Packet PM

Table A.6 - 10201 Packet PM

Parameter	Specification
General	
Supported PLMs	10300 DS3 10301 HSSI 10306 E3 10309 Quad V.35/EIA-530 10310 J2
Processing capacity	52 Mbps
Interface types supported	Frame-based interfaces, user-selectable: ATM DXI/FUNI Frame Relay UNI HDLC frames (frame forwarding mode of operation)
Services supported/modes of operation	Frame Relay over ATM. Service or network interworking per virtual connection via Frame Relay UNI. Service interworking only via ATM DXI/FUNI. Utilizes AAL5. HDLC Frame Forwarding (of HDLC named data). Utilizes AAL5.
Traffic types handled	VBR only
Connections	
Number of virtual connections per port	HDLC Frame Forwarding Mode: One virtual connection for all HDLC frames. All traffic routed to a single destination (channel extension) over an ATM UNI or to another HDLC port (AAL5). Frame Relay UNI: 2047 VCC's or DLCIs (AAL5). ATM DXI - two options, user selectable: Mode 1b. Maximum of 2048 connections, of which up to 255 can be VPCs (AAL5). Mode 1b Extended - Same as Mode 1b except DXI header uses four octets instead of two.

Table A.6 - 10201 Packet PM

Parameter	Specification
Traffic and Congestion Management	
General	Congestion management algorithm with Early Packet Discarding and 4 VBR priorities
Input queuing	Two options: Non-blocking input queue Input buffers of up to 64 packets with a maximum length of 9232 octets. Closed Loop Flow Control can be activated for up to eight destination ports.
Output queuing	VBR output queues, with traffic and congestion management capability
Reassembly	Up to 128 simultaneous reassembly buffers of packets up to 9232 octets in length. User-selectable increase in number of simultaneous reassemblies to 36 with MTU reduced to 4616 octets.
Rate control	PCR and SCR rate control / UPC for CLP 0+1, per virtual connection
Maximum burst size / burst tolerance	210 cells
Statistics Collection	
Statistics collected per port	Number of valid cells (input and output) Number of cells discarded for PCR violation Number of cells discarded for congestion Number of valid packets (input and output) Number of cells discarded for invalid address (DLCI or DFA) Number of discarded input packets (FCS errors) Number of discarded AAL5 CPCS_PDUs (CRC error after reassembly) Number of packets discarded due to reassembly time-outs Number of packets discarded due to unavailable reassembly buffer
Standards Compliance (meets applicable requirements of the following standards / generic requirements):	

Table A.6 - 10201 Packet PM

Parameter	Specification
The 16-bit FCS shall be the one specified in CCITT Q.291 (CRC-16).	
The 32-bit CRC (FCS) shall be the one specified in ISO 9314-2, 1989.	
The primary specifications which define the functions performed by OAM cells are: Chapter 4 of Bellcore GR-1113, "Asynchronous Transfer Mode (ATM) and ATM Adaptation Layer (AAL) Protocols" Issue 1, July 1994 ITU-T I.610, B-ISDN "Operation and Maintenance Principles and Functions" March, 1993. The format of the ATM DXI packets themselves is defined in: ATM Forum "ATM Data Exchange Interface (DXI) Specification Version 1.0," August 4, 1993. For AAL5 connections: Chapter 8 of Bellcore GR-1113, "Asynchronous Transfer Mode (ATM) and ATM Adaptation Layer (AAL) Protocols" Issue 1, July 1994. ATM Data Exchange Interface (DXI), Version 1. August 4, 1993. ITU-T Q.922 "ISDN Data Link Layer Specifications for Frame Mode Bearer Services" 1992.	

A.4.2 10202 Quad Cell PM

Table A.7 - 10202 Quad Cell PM

Parameter	Specification
General	
Supported PLMs	10302 Quad DSX-1 10307 Quad E1
Processing capacity	2.048 Mbps (4528.3 cells / second) per port
Interface types supported	ATM UNI (for network or user ports)
Traffic types handled	CBR and VBR
Connections	
Number of virtual connections per port	ATM UNI Mode: Up to 255 virtual path connections (VPCs) or 1024 virtual channel connections (VCCs) or combinations thereof up to 4096 total connections SNI Mode: One virtual connection with MID multiplexing capability
Traffic and Congestion Management	
General	Congestion management algorithm with Early Packet Discarding and 4 VBR priorities CBR not subject to congestion
Input queuing	Non-blocking separate CBR and VBR input queues
Output queuing	Separate CBR and VBR output queues, with traffic and congestion management capability
Rate control	PCR and SCR rate control / UPC for CLP 0+1, per virtual connection
Maximum burst size / burst tolerance	210 cells
Cell emission scheduling for minimal CDV	Per virtual connection for CBR Per input port for VBR
Maximum CDV	250 µs

Table A.7 - 10202 Quad Cell PM

Parameter	Specification
Statistics Collection	
Statistics collected per port	Number of valid cells Number of cells discarded for HEC errors Number of cells discarded for PCR violation Number of cells discarded for congestion Number of cells discarded for invalid connection identification
Standards Compliance (Meets applicable requirements of the following standards / generic requirements):	
ATM Forum UNI Version 3.1, September 1994, "User-Network Interface Specifications"	
Bellcore GR-2848-CORE, June 1994, "Broadband Multi-service User-Network Interface Generic Requirements"	
Bellcore TR-TSV-000772, May 1991, "Generic Requirements in Support of Switched Multi-Megabit Data Service"	
Bellcore GR-1113-CORE, July 1994, "Asynchronous Transfer Mode (ATM) and ATM Adaptation Layer (AAL) Protocols Generic Requirements"	
Bellcore GR-2842-CORE, November 1994, "ATM Service Access Multiplexer (SAM) Generic Requirements"	
Bellcore GR-1113-CORE, July 1994, "Asynchronous Transfer Mode (ATM) and ATM Adaptation Layer (AAL) Protocols Generic Requirements"	
ITU-T Recommendation I.413, "Broadband ISDN User-Network Interface"	
ITU-T Recommendation I.311, "Broadband ISDN General Aspects"	
ITU-T Recommendation I.150, "Asynchronous Transfer Mode Functional Characteristic"	
ITU-T Recommendation I.361, "Broadband ISDN ATM Layer Specification"	
ITU-T Recommendation I.363, "Broadband ISDN Adaptation Layer Specification"	
ITU-T Recommendation I.371, "Traffic Control and Congestion Control in B-ISDN"	

A.4.3 10203 Quad Packet/CBR PM

Table A.8 - 10203 Quad Packet / CBR PM (Packet Specifications)

Parameter	Specification
General	
Supported PLMs	10302 Quad DSX-1 10303 Tri V.35 / EIA-530 & DSX-1 10307 Quad E1 10308 Tri V.35 / EIA-530 & E1 10309 Quad V.35 / EIA-530
Processing capacity	2.048 Mbps per port
Interface types supported	Frame-based interfaces, user-selectable: Frame Relay UNI ATM DXI / FUNI HDLC frames (frame forwarding mode of operation)
Services supported / modes of operation	Frame Relay over ATM (AAL5). Service or network interworking per virtual connection via Frame Relay UNI. ATM DXI / FUNI (AAL5). HDLC Frame Forwarding (of HDLC framed data) (AAL5).
Connections	
Number of virtual connections per port	HDLC Frame Forwarding Mode: One virtual connection for all HDLC frames. All traffic routed to a single destination (channel extension) over an ATM UNI or to another HDLC port (AAL5). Frame Relay UNI: 512 VCC's or DLCIs (AAL5). ATM DXI: Maximum of 512 connections, 255 of which can be VPCs (AAL5).
Traffic and congestion management	
General	Congestion management algorithm with partial packet / early packet discard and 4 VBR priorities
Input queuing	Non-blocking input queue

Table A.8 - 10203 Quad Packet / CBR PM (Packet Specifications)

Parameter	Specification
Output queuing	VBR output queue, with traffic and congestion management capability
Reassembly	Up to 18 simultaneous reassembly buffers of packets up to 9232 octets in length User-selectable increase in number of simultaneous reassemblies to 36 with MTU reduced to 4616 octets
Rate control	PCR and SCR rate control / UPC for CLP 0+1, per virtual connection
Maximum burst size / burst tolerance	210 cells
Cell emission scheduling - minimal CDV	Per input port
Maximum CDV (CBR only)	250 µs per port (no assurance per connection)
Statistics collection	
Statistics collected per port	Number of valid cells (input and output) Number of cells discarded for PCR violation Number of cells discarded for congestion Number of valid packets (input and output) Number of packets discarded for invalid address (DLCI or DFA) Number of discarded input packets (FCS errors) Number of discarded AAL5 CPCS_PDUs (CRC error after reassembly) Number of packets discarded due to reassembly time-outs Number of packets discarded due to unavailable reassembly buffer
Standards Compliance (Meets applicable requirements of the following standards / generic requirements):	
ATM Forum Contribution. ATMF 94-0996, “Frame Relay / ATM PVC Service Interworking Implementation Agreement.”	
ATM Forum COntribution, “Frame Relay / ATM PVC Network Interworking Implementation Agreement.”	
Bellcore GR-1113-CORE, “Asynchronous Transfer Mode (ATM) and ATM Adaptation Layer (AAL) Protocols Generic Requirements,” July 1994.	

Table A.8 - 10203 Quad Packet / CBR PM (Packet Specifications)

Parameter	Specification
Bellcore GR-2842-CORE, "ATM Service Access Multiplexer (SAM) Generic Requirements,: November 1994.	
Bellcore TA-NWT-001110, "Broadband ISDN Switching System Generic Requirements," August 1992.	
ITU-T Recommendation I.311, "Broadband ISDN General Aspects."	
ITU-T Recommendation I.150, "Asynchronous Transfer Mode Functional Characteristic."	
ITU-T Recommendation I.361, "Broadband ISDN ATM Layer Specification."	
ITU-T Recommendation I.363, "Broadband ISDN Adaptation Layer Specification"	
ITU-T Recommendation I.364, "Support of Broadband Connectionless Data Service on B-ISDN"	
ITU-T Recommendation I.555, "Frame Relaying Bearer Service Interworking"	
ITU-T Recommendation I.371, "Traffic Control and Congestion Control in B-ISDN"	

Table A.9 - 10203 Quad Packet / CBR PM (CBR Specifications)

Parameter	Specification
General	
Processing capacity	2.048 Mbps (4528.3 cells / second) per port
Interface types supported	Serial constant bit rate
Services supported / modes of operation	CBR Circuit Emulation Service, unstructured mode of operation (AAL1); supports unstructured interoperability between V.35 CBR and DSX-1 or E1 CBR.
Connections	
Number of virtual connections per port	One active connection at a time
Traffic and congestion management	
General	No congestion management. Congestion may occur only due to misallocating bandwidth. This results in cell discard and immediate alarm.
Input queuing	Non-blocking input queue
Output queuing / reassembly	One reassembly output queue with user-controllable depth. Depth influences Cell Delay Variation Tolerance (higher depth = higher CDVT). Six cells reassembly latency. (Latency is a one-time delay introduced at the activation of the connection.) User-selectable depth of queue for 12 to 21 cells in 3-cell steps.
Cell emission scheduling for minimal CDV	Per connection (one connection per port)
Maximum CDV	250 µs
Statistics Collection	

Table A.9 - 10203 Quad Packet / CBR PM (CBR Specifications)

Parameter	Specification
Statistics collected per port	Number of received valid cells Number of cells discarded due to corrupted AAL1 header Number of cells discarded or missing due to mis-sequencing (non-contiguous sequence number in contiguous cells)
Standards Compliance (Meets applicable requirements of the following standards / generic requirements):	
ATM Forum AF-SAA-0032-000, "Circuit Emulation Service Interoperability Specification", June 1995	
Bellcore GR-1113-CORE, "Asynchronous Transfer Mode (ATM) and ATM Adaptation Layer (AAL) Protocols Generic Requirements", July 1994	
Bellcore-GR-2842-CORE, "ATM Service Access Multiplexer (SAM) Generic Requirements", November 1994	
Bellcore TA-NWT-001110, "Broadband ISDN Switching System Generic Requirements", August 1992	
ITU-T Recommendation I.311, "Broadband ISDN Generic Aspects"	
ITU-T Recommendation I.150, "Asynchronous Transfer Mode Functional Characteristic"	
ITU-T Recommendation I.361, "Broadband ISDN ATM Layer Specification"	
ITU-T Recommendation I.363, "Broadband ISDN Adaptation Layer Specification"	
ITU-T Recommendation I.371, "Traffic Control and Congestion Control in B-ISDN"	

A.4.4 10205 Quad Packet PM

Table A.10 - 10205 Quad Packet PM

Parameter	Specification
General	
Supported PLMs	10302 Quad DSX-1 10303 Tri V.35 / EIA-530 & DSX-1 10307 Quad E1 10308 Tri V.35 / EIA-530 & E1 10309 Quad V.35 / EIA-530
Processing capacity	2.048 Mbps (4528.3 cells / second) per port
Interface types supported	Frame-based interfaces, user-selectable: ATM DXI / FUNI Frame Relay UNI, HDLC frames (frame forwarding mode of operation)
Services supported / modes of operation	Frame Relay over ATM. Service or network interworking per virtual connection via Frame Relay UNI. Service interworking only via ATM DXI / FUNI. Utilizes AAL5. ATM DXI / FUNI (AAL5). HDLC Frame Forwarding (of HDLC framed data). Utilizes AAL5.
Connections	
Number of virtual connections per port	HDLC Frame Forwarding Mode: One virtual connection for all HDLC frames. All traffic routed to a single destination (channel extension) over an ATM UNI or to another HDLC port. Utilizes AAL5. Frame Relay UNI: 512 VCC's (DLCIs). Utilizes AAL5. ATM DXI: Maximum of 512 connections, of which up to 255 can be VPCs. Utilizes AAL5.
Traffic and congestion management	

Table A.10 - 10205 Quad Packet PM

Parameter	Specification
General	Congestion management algorithm with partial packet discard and early packet discard and 4 VBR priorities
Input queuing	Non-blocking input queue
Output queuing	VBR output queue, with traffic and congestion management capability
Reassembly	Up to 18 simultaneous reassembly buffers of packets up to 9232 octets in length User-selectable increase in number of simultaneous reassemblies to 36 with MTU reduced to 4616 octets
Rate control	PCR and SCR rate control / UPC for CLP 0+1, per virtual connection
Maximum burst size / burst tolerance	210 cells
Statistics collection	
Statistics collected per port	Number of valid cells (input and output) Number of cells discarded for PCR violation Number of cells discarded for congestion Number of valid packets (input and output) Number of packets discarded for invalid address (DLCI or DFA) Number of discarded input packets (FCS errors) Number of discarded AAL5 CPCS_PDUs (CRC error after reassembly) Number of packets discarded due to reassembly time-outs Number of packets discarded due to unavailable reassembly buffer
Standards Compliance (meets applicable requirements of the following standards / generic requirements):	
ATM Forum Contribution. ATMF 94-0996, “Frame Relay / ATM PVC Service Interworking Implementation Agreement.”	
ATM Forum COntribution, “Frame Relay / ATM PVC Network Interworking Implementation Agreement.”	

Table A.10 - 10205 Quad Packet PM

Parameter	Specification
Bellcore GR-1113-CORE, “Asynchronous Transfer Mode (ATM) and ATM Adaptation Layer (AAL) Protocols Generic Requirements,” July 1994.	
Bellcore GR-2842-CORE, “ATM Service Access Multiplexer (SAM) Generic Requirements,: November 1994.	
Bellcore TA-NWT-001110, “Broadband ISDN Switching System Generic Requirements,” August 1992.	
ITU-T Recommendation I.311, “Broadband ISDN General Aspects.”	
ITU-T Recommendation I.150, “Asynchronous Transfer Mode Functional Characteristic.”	
ITU-T Recommendation I.361, “Broadband ISDN ATM Layer Specification.”	
ITU-T Recommendation I.363, “Broadband ISDN Adaptation Layer Specification”	
ITU-T Recommendation I.364, “Support of Broadband Connectionless Data Service on B-ISDN”	
ITU-T Recommendation I.555, “Frame Relaying Bearer Service Interworking”	
ITU-T Recommendation I.371, “Traffic Control and Congestion Control in B-ISDN”	

A.5 *CellPath* 300 Physical Layer Modules (PLMs)

Tables A.11 through A.22 contains the specifications of each of the supported Physical Layer Modules (PLMs).

A.5.1 10300 DS3 PLM

Table A.11 - 10300 DS3 PLM

Parameter	Specification
Common Requirements	
Interface connector	75 ohm coaxial BNC connectors
Line rate, internal clock	44.736 Mbps ±20 ppm
Line code	B3ZS
Line impedance	75 ohms (nominal)
Framing format	M23 or C-bit parity
Input Requirements	
Signal level	Recover DSX-3 signals from 0 to 450 ft of WECO 728A 75 ohm coaxial cable or equivalent.
Jitter tolerance	Conforms to ITU-T Recommendation G.824 (03/93), Section 3.1.1, Table 2.
Output Requirements	
Output level, V_o	$0.36 < V_o < 0.85$ V peak (as measured at the center of the pulse) at the cross-connect
Pulse shape	Conforms to TR-NWT-000499, Issue 5, Figure 9-6.
Line build out: DS3 High DSX-3	For cable lengths: 225 to 450 feet 0 to 225 feet
Output jitter generation	Conforms to ITU-T Recommendation G.824 (03/93), Section 2.1, Table 1.
Standards compliance Meets applicable requirements of the following standards/generic requirements:	

Table A.11 - 10300 DS3 PLM

Parameter	Specification
ANSI T1.102-1993, Standard for Telecommunications, “Digital Hierarchy - Electrical Interfaces,” December 8, 1993.	
ANSI T1.107a-1990, Standard for Telecommunications, “Digital Hierarchy - Supplement to Formats Specification, (DS3 format applications),” August 16, 1990.	
ANSI T1.404-1994, Standard for Telecommunications, “Network-to-Customer Installation - DS3 Metallic Interface,” August 30, 1994.	
ITU-T G.824-1993, “Digital Networks - The Control of Jitter and Wander within Digital Networks which are Based on the 1544 kbit/s Hierarchy,” March 1993.	
Bellcore TR-NWT-000499-Issue 5, “Transport Systems Generic Requirements (TSGR): Common Requirements,” December 1993.	

A.5.2 10301 HSSI PLM

Table A.12 - 10301 HSSI PLM Electrical Specifications

Parameter	Specification
Common Requirements	
Maximum differential input voltage	1.5V
Maximum comm mode input voltage	-2.85V to -.8V
Balanced Signals	
Input sensitivity	<150 mV
Line impedance	110 ohms
Output voltage V_o	.59 V_{pp} < V_o <1.5 V_{pp}
DC line oset	100 mV max
Output short circuit current	≤50 mA
Rise and fall time	0.5 ns ≤ t ≤ 2.3 ns

A.5.3 10302 Quad DSX-1 PLM

Table A.13 - 10302 Quad DSX-1 PLM

Parameter	Specification
Common Requirements	
Interface connector	DA15S
Line code	B8ZS or AMI
Framing format	ESF or SF (D4)
Line rate, internal clock	1.544 Mbps ±20 ppm
Fractional support	N x 64 or N x 56
Input Requirements	
Line rate tolerance	1.544 Mbps ±200 bps
Signal level	DSX-1 to -10 dB
Jitter tolerance	Conforms to ITU-T Recommendation G.824 (03/93), Section 3.1.1, Table 2.
Output Requirements	
Output level	DSX-1 at the connector
Pulse shape	Conforms to ANSI T1.403-1989 Section 5.3.4.1, Figure 2.
Jitter generation	Conforms to ITU-T Recommendation G.824 (03/93), Section 2.1, Table 1.
Standards compliance Meets applicable requirements of the following standards/generic requirements:	
ANSI T1.403-1995, Standard for Telecommunications, "Network-to-Customer Installation - DS1 Metallic Interface," March 21, 1995.	
ANSI T1.102-1993, Standard for Telecommunications, "Digital Hierarchy - Electrical Interfaces," December 8, 1993.	
ANSI T1.107-1988, Standard for Telecommunications, "Digital Hierarchy - Formats Specification," August 25, 1988.	
ITU-T G.824-1993, "Digital Networks - The Control of Jitter and Wander within Digital Networks which are Based on the 1544 kbit/s Hierarchy," March 1993.	

A.5.4 10303 Tri V.35/EIA-530 & DSX-1 PLM

The Tri V.35/EIA-530 & DSX-1 module can be configured, via system software, to be a V.35-compatible or an EIA-530-compatible interface. The EIA-530 interface also supports EIA-449 (RS449) and X.21 pinouts with appropriate cabling. This physical layer module supports three V.35/EIA-530 ports and one DSX-1 port.

Table A.14 - 10303 Tri V.35/EIA-530

Parameter	Specification
Common Requirements	
Maximum differential input voltage	12V
Maximum common mode input voltage	10V
Balanced Signals (Transmit/Receive Data, CTS, Received Line Signal Detector, Transmit/Receive Signal Element Timing)	
Input sensitivity	<200 mV
Source impedance	<100 ohms
Output voltage V_0 (EIA-530)	2 V < V_0 < 6 V
Output voltage V_0 (V.35)	1.10 Vpp ±20%
DC line offset	0.4 V max
Output short circuit current	< 150 mA
Output leakage current Iol	< 100 µA
Unbalanced Signals (DCE Ready, DTE Ready, Local Loopback, Remote Loopback, Test Mode, Ring Indicator)	
Input sensitivity	< 200 mV
Output drive	> 90% of V_0 into 450 ohms
Standards compliance Meets applicable requirements of the following standards/generic requirements:	
ANSI/EIA-530-1987, EIA Standard, "High Speed 25-Position Interface for Data Terminal Equipment and Data Circuit-Terminating Equipment," March 1987.	
CCITT V.35 Red Book 1985, "Data Communications over the Telephone Network Recommendations for the V Series."	

Table A.15 - 10303 DSX-1 PLM

Parameter	Specification
Common Requirements	
Interface connector	DA15S
Line code	B8ZS or AMI
Framing format	ESF or SF (D4)
Line rate internal clock	1.544 Mbps ±20ppm
Fractional support	N x 64 or N x 56
Input Requirements	
Line rate tolerance	1.544 Mbps ±200 bps
Signal level	DSX-1 to -10 dB
Jitter tolerance	Conforms to ITU-T Recommendation G.824 (03/93), Section 3.1.1, Table 2
Output Requirements	
Output level	DSX-1 at the connector
Pulse shape	Conforms to ANSI T1.403-1989 Section 5.3.4.1, Figure 2
Jitter generation	Conforms to ITU-T Recommendation G.824 (03/93), Section 2.1, Table 1
Standards compliance Meets applicable requirements of the following standards/generic requirements:	
ANSI T1.403-1995, Standard for Telecommunications, “Network-to-Customer Installation - DS1 Metallic Interface,” March 21, 1995.	
ANSI T1.102-1993, Standard for Telecommunications, “Digital Hierarchy - Electrical Interfaces,” December 8, 1993.	
ANSI T1.107-1988, Standard for Telecommunications, “Digital Hierarchy - Formats Specification,” August 25, 1988.	
ITU-T G.824-1993, “Digital Networks - The Control of Jitter and Wander within Digital Networks which are Based on 1544 kbit/s Hierarchy,” March 1993.	

A.5.5 10304 OC3c/STM1 Multimode PLM

Table A.16 - 10304 OC-3c/STM1 Multimode PLM

Parameter	Specification
Common requirements	
Interface connector	Duplex SC
Line rate, internal clock	155.52 Mbps
Line code	Binary NRZ
Stream scrambler	SONET/SDH required scrambler
Cell scrambler	ATM payload scrambler
Framing format	STS-3c/STM1
Fiber type	2 point-to-point multimode 62.5 µm core with 125 µm cladding fibers.
Typical range	0 to 2 km using cable with minimum bandwidth of 500 MHz-km
Input Requirements	
Minimum received power	-30 dBm
Maximum received power	-14 dBm
Jitter tolerance 10 Hz to 30 Hz	No more than 15 UI peak-to-peak measured over 60 sec.
Jitter tolerance 300 Hz to 6.5 KHz	No more than 1.5 UI peak-to-peak measured over 60 sec.
Jitter Tolerance > 65 KHz	No more than 0.15 UI peak-to-peak measured over 60 sec.
Output Requirements	
Output power level	-20 dBm to -14 dBm
Wavelength	1260 nm to 1360 nm Nominally 1310 nm
Spectral width	75 nm RMS
Minimum extinction ratio	10 dB (TR-NWT-001112 Issue 1, Section 4.11.2.4, Table 4-8)

Table A.16 - 10304 OC-3c / STM1 Multimode PLM

Parameter	Specification
Eye pattern mask	ATM Forum UNI version 3.1, Figure 2-18
Jitter 500 Hz to 1.3 MHz	No more than 1.5 UI peak-to-peak measured over 60 seconds
Jitter 65 kHz to 1.3 MHz	No more than 0.15 UI peak-to-peak measured over 60 seconds
Jitter generation 12 kHz to > 1.3 MHz	No more than 0.15 UI peak-to-peak or 0.015 UI RMS measured over 60 seconds
Standards compliance Meets applicable requirements of the following standards / generic requirements:	
T1.105-1991, American National Standard for Telecommunications, “Digital Hierarchy - Optical Interface Rates and Formats Specifications,” July 1991.	
Bellcore TR-NWT-001112-Issue 1, “Broadband-ISDN User to Network Interface and Network Node Interface Physical Layer Generic Criteria,” June 1993.	
ITU-T G.708-1993, “General Aspects of Digital Transmission Systems - Network Node Interface for the Synchronous Digital Hierarchy.”	
ITU-T G.825-1993, “Digital Networks - The Control of Jitter and Wander within Digital Networks which are Based on the Synchronous Digital Hierarchy (SDH).”	
ITU-T G.957-1993, “Digital Sections and Digital Line Systems - Optical Interfaces for Equipments and Systems relating to the Synchronous Hierarchy,” March 1993.	
ITU-T G.958-1993, “Digital Hierarchy and Digital Line Systems - Digital Line Systems based on the Synchronous Digital Hierarchy for use on Optical Fibre Cables,” March 1993.	

A.5.6 10305 OC3c/STM1 Single-mode PLM

Table A.17 - 10305 OC-3c / STM1 Single-mode PLM

Parameter	Specification
Common Requirements	
Interface connector	Duplex SC
Line rate, internal clock	155.52 Mbps
Line code	Binary NRZ
Stream scrambler	SONET / SDH required scrambler
Cell scrambler	ATM payload scrambler
Framing format	STS-3c
Fiber type	2 point-to-point single-mode 8 µm core fibers
Typical range	0 to 25 km
Input Requirements	
Minimum received power	-28 dBm
Maximum received power	-8 dBm
Jitter tolerance 10 Hz to 30 Hz	No more than 15 UI peak-to-peak measured over 60 seconds.
Jitter tolerance 300 Hz to 6.5 kHz	No more than 1.5 UI peak-to-peak measured over 60 seconds.
Jitter tolerance > 65 kHz	No more than 0.15 UI peak-to-peak or 0.015 UI rms measured over 60 seconds.
Output Requirements	
Output power level	-15 dBm to -8 dBm
Wavelength	1260 nm to 1360 nm Nominally 1310 nm
Spectral width	7.7 nm RMS
Minimum extinction ratio	8.2 dB (TR-NWT-001112 Issue 1, Section 4.10.4.3, Table 4-6)
Eye pattern mask	ATM UNI version 3.0, Figure 2-18

Table A.17 - 10305 OC-3c / STM1 Single-mode PLM

Parameter	Specification
Jitter 500 Hz to 1.3 MHz	No more than 1.5 UI peak-to-peak measured over 60 seconds
Jitter 65 kHZ to 1.3 MHz	No more than 0.15 UI peak-to-peak measured over 60 seconds
Jitter generation 12 kHz to > 1.3 MHz	No more than 0.15 UI peak-to-peak or 0.015 UI RMS measured over 60 seconds
Standards compliance Meets applicable requirements of the following standards / generic requirements.	
T1.105-1991, American National Standard for Telecommunications "Digital Hierarchy - Optical Interface Rates and Formats Specifications," July 1991.	
Bellcore TR-NWT-001112-Issue 1, "Broadband-ISDN User to Network Interface and Network Node Interface Physical Layer Generic Criteria," June 1993.	
ITU-T G.708-1993, "General Aspects of Digital Transmission Systems - Network node Interface for the Synchronous Digital Hierarchy (SDH)."	
ITU-T G.825-1993, "Digital Networks - The Control of Jitter and Wander within Digital Networks which are Based on the Synchronous Digital Hierarchy (SDH)."	
ITU-T G.957-1993, "Digital Sections and Digital Line Systems - Optical Interfaces for Equipments and Systems relating to the Synchronous Digital Hierarchy," March 1993.	
ITU-T G.958-1993, "Digital Sections and Digital Line Systems - Digital Line Systems based on the Synchronous Digital Hierarchy for use on Optical Fibre Cables," March 1993.	

A.5.7 10306 E3 PLM

Table A.18 - 10306 E3 PLM

Parameter	Specification
Common Requirements	
Interface connector	75 ohm coaxial BNC connectors
Line rate, internal clock	34.386 Mbps ±20 ppm
Line Code	HDB3
Line impedance	75 ohms (nominal)
Framing format	ITU-T Recommendation G.751 or G.832
Input Requirements	
Input recovery	Recover E3 signals with 0 to 12 dB of loss at 17.184 MHz
Return loss	> 12dB @ 860 to 1720 kHz > 18dB @ 1720 to 34368 kHz > 14dB @ 34368 to 51550 kHz
Jitter tolerance	Conforms to ITU-T Recommendation G.823 (03/93), Section 3.1.1, Table 2.
Output Requirements	
Output level, V_o	1.0 V peak at transmitter
Pulse shape	Conforms to ITU-T Recommendation G.703 (1991), Section 8, Figure 17
Jitter generation	Conforms to ITU-T Recommendation G.823 (03/93), Section 2.1, Table 1.
Standards compliance Meets applicable requirements of the following standards/generic requirements.	
CCITT G.703-1991, "General Aspects of Digital Transmission Systems; Terminal Equipments - Physical/Electrical Characteristics of Hierarchal Digital Interfaces."	
CCITT G.704-1991, "General Aspects of Digital Transmission Systems; Terminal Equipments - Synchronous Frame Structures used at primary and Secondary Hierarchal Levels."	

Table A.18 - 10306 E3 PLM

Parameter	Specification
CCITT G.706-1991, “General Aspects of Digital Transmission Systems; Terminal Equipments - Frame Alignment and Cyclic Redundancy Check (CRC) Procedures relating to Basic Frame Structures Defined in Recommendation G.704.”	
ITU-T G.751-1993, “General Aspects of Digital Transmission Systems; Terminal Equipments - Digital Multiplex Equipment Operating at the Third Order Bit Rate of 34 368 kbit/s and the Fourth Order Bit Rate of 139 264 kbit/s and using Positive Justification.”	
ITU-T G.775-Draft, “Loss of Signal (LOS) and Alarm Indication Signal (AIS) Defect Detection and Clearance Criteria,” October 1993.	
ITU-T G.804-1993, “Digital Networks - ATM Cell Mapping into Plesiochronous Digital Hierarchy (PDH),” November 1993.	
ITU-T G.823-1993, “Digital Networks - The Control of Jitter and Wander within Digital Networks which are Based on the 2048 kbit/s Hierarchy,” March 1993.	
ITU-T G.823-1993, “Digital Networks - Transport of SDH Elements on PDH Networks: Frame and Multiplexing Structures,” November 1993.	

A.5.8 10307 Quad E1 PLM

Table A.19 - 10307 Quad E1 PLM

Parameter	Specification
Common Requirements	
Interface connector	DA15S
Line code	HDB3
Framing format	Conforms to ITU-T Recommendation G.704. Time slot 16 Multiframing may be enabled or disabled.
Input Requirements	
Line rate, internal clock	2.048 Mbps ±20ppm
Fractional support	N x 64
Line rate tolerance	2.048 Mbps ±50ppm
Signal level	+2 to -25 dB
Jitter tolerance	Conforms to ITU-T Recommendation G.823 (03/93), Section 3.1.1, Table 2.
Output Requirements	
Output level	2.37 volts into 75 ohms 3.0 volts into 120 ohms
Pulse shape	Conforms to ITU-T Recommendation G.703 (1991), Section 6.2, Figure 15.
Jitter generation	Conforms to ITU-T Recommendation G.823 (03/93), Section 2.1, Table 1.
Standards compliance Meets applicable requirements of the following standards/generic requirements.	
CCITT G.703-1991, "General Aspects of Digital Transmission Systems; Terminal Equipments - Physical/Electrical Characteristics of Hierarchal Digital Interfaces."	
CCITT G.704-1991, "General Aspects of Digital Transmission Systems; Terminal Equipments - Synchronous Frame Structures used at Primary and Secondary Hierarchal Levels."	

Table A.19 - 10307 Quad E1 PLM

Parameter	Specification
CCITT G.706-1991, “General Aspects of Digital Transmission Systems; Terminal Equipments - Frame Alignment and Cyclic Redundancy Check (CRC) Procedures relating to Basic Frame Structures Defined in Recommendation G.704.”	
ITU-T G.804-1993, “Digital Networks - ATM Cell Mapping into Plesiochronous Digital Hierarchy (PDH), “November 1993.	
ITU-T G.823-1993, “Digital Networks - The Control of Jitter and Wander within Digital Networks which are Based on the 2048 kbit/s Hierarchy,” March 1993.	

A.5.9 10308 Tri V.35/EIA-530 & E1 PLM

Table A.20 - 10308 Tri V.35 / EIA-530 PLM

Parameter	Specification
Common Requirements	
Maximum differential input voltage	12V
Maximum common mode input voltage	10V
Balanced Signals (TD / RD, CTS, Received Line Signal Detector, Transmit / Receive Signal Element Timing)	
Input sensitivity	< 200 mV
Source impedance	< 100 ohms
Output voltage V_0 (EIA-530)	2 V < V_0 < 6 V
Output voltage V_0 (V.35)	1.10 Vpp ±20%
DC line offset	0.4 V max
Output short circuit current	< 150 mA
Output leakage current Iol	< 100 µV
Unbalanced Signals (DCE Ready, DTE Ready, Local Loopback, Test Mode Ring Indicator)	
Input sensitivity	< 200 mV
Output drive	> 90% of V_0 into 450 ohms
Standards compliance Meets applicable requirements of the following standards / generic requirements.	
ANSI / EIA-530-1987, EIA Standard, “High Speed 25-Position Interface for Data Terminal Equipment and Data Circuit-Terminating Equipment,” March 1987.	
CCITT V.35 Red Book 1985, “Data Communication over the Telephone Network Recommendations for the V Series.”	

Table A.21 - 10308 E1 PLM

Parameter	Specification
Common Requirements	
Interface connector	DA15S
Line code	HDB3
Framing format	Conforms to ITU-T Recommendation G.704. Time slot 16 Multiframing may be enabled or disabled.
Line rate internal clock	2.048 Mbps ±20ppm
Fractional support	N x 64
Input Requirements	
Line rate tolerance	2.048 Mbps ±50ppm
Signal level	+2 to -25 dB
Jitter tolerance	Conforms to ITU-T Recommendation G.823 (03/93), Section 3.1.1, Table 2
Output Requirements	
Output level	2.37 volts into 75 ohms 3.0 volts into 120 ohms
Pulse shape	Conforms to ITU-T Recommendation G.703 (1991), Section 6.2, Figure 15
Jitter generation	Conforms to ITU-T Recommendation G.823 (03/93), Section 2.1, Table 1
Standards compliance Meets applicable requirements of the following standards/generic requirements.	
CCITT G.703-1991, “General Aspects of Digital Transmission Systems; Terminal Equipments - Physical/Electrical Characteristics of Hierarchal Digital Interfaces.”	
CCITT G.704-1991, “General Aspects of Digital Transmission Systems; Terminal Equipments - Synchronous Frame Structures used at Primary and Secondary Hierarchal Levels.”	
CCCITT G.706-1991, “General Aspects of Digital Systems; Terminal Equipments - Frame Alignment and Cyclic Redundancy Check (CRC) Procedures relating to Basic Frame Structures in Recommendation G.704.”	

Table A.21 - 10308 E1 PLM

Parameter	Specification
ITU-T G.804-1993, “Digital Networks - ATM Cell Mapping into Plesiochronous Digital Hierarchy (PDH),” November 1993.	
ITU-T G.823-1993, “Digital Networks - The Control of Jitter and Wander within Digital Networks which are Based on the 2048 kbit/s Hierarchy,” March 1993.	

A.5.10 10309 Quad V.35/EIA-530 PLM

Table A.22 - 10309 Quad V.35/EIA-530 PLM

Parameter	Specification
Common requirements	
Maximum differential input voltage	12V
Maximum common mode input voltage	10V
Balanced signals (TD/RD, CTS, Received Line Signal Detector, Transmit/Receive Signal Element Timing)	
Input sensitivity	< 200 mV
Source impedance	< 100 ohms
Output voltage V_0 (EIA-530)	2 V < V_0 < 6 V
Output voltage V_0 (V.35)	1.10 Vpp ±20%
DC line offset	0.4 V max
Output short circuit current	< 150 mA
Output leakage current Iol	< 100 µA
Unbalanced signals (DCE Ready, DTE Ready, Local/Remote Loopback, Test Mode, Ring Indicator)	
Input sensitivity	< 200 mV
Output drive	> 90% of V_0 into 450 ohms
Standards compliance Meets applicable requirements of the following standards/generic requirements.	
ANSI/EIA-530-1987, EIA Standard, "High Speed 25-Position Interface for Data Terminal Equipment and Data Circuit-Terminating Equipment," March 1987.	
CCITT V.35 Red Book 1985, "Data Communication over the Telephone Network Recommendations for the V Series."	

A.5.11 10310 J2 PLM

Table A.23 - 10310 J2 PLM

Parameter	Specification
Common Requirements	
Interface connector	75 ohm coaxial BNC connectors
Line rate, internal clock	6312 Kbps ±30 ppm
Line code	B8ZS
Line impedance	75 ohms (nominal)
Framing support	ITU-T Recommendation G.704, section 2.2
Output Requirements	
Pulse shape	Conforms to NTT2: Technical Reference of Cell Relay Interface, Draft Ver. 1, Nippon Telegraph & Telephone Corporation, Nov, 1993 figure 1.2.2

A.5.12 10312 IMA DS1 PLM

Table A.24 - 10312 IMA DS1 PLM

Parameter	Specification
Common Requirements	
Interface connector	RJ48C
Line code	B8ZS
Framing format	ESF or SF (D4)
Line rate internal clock	1.544 Mbps ± 50 bps
Input requirements	
Line rate tolerance	1.544 Mbps ± 50 bps
Signal level	0 to -22 dB
Jitter tolerance	Conforms to ITU-T Recommendation G.824 (03/93), Section 3.1.1, Table 2.
Output Requirements	
Output level	2.7 to 3.3 V Peak
Line build out attentuation	0 dB, 7.5 dB, 15 dB, or 22.5 dB
Pulse shape	Conforms to ANSI T1.403-1989 Section 5.3.4.1, Figure 2. TR62411 Dec 1990, Sec. 4.6.2.3.1, Figure 21. FCC Part 68.
Jitter generation	Conforms to ITU-T Recommendation G.824 (03/93), Section 2.1, Table 1.

A.5.13 10313 IMA E1 PLM

Table A.25 - 10313 IMA E1 PLM

Parameter	Specification
Common Requirements	
Interface connector	RJ45C
Line code	HDB3
Framing format	FAS
Line rate, internal clock	2.048 Mbps ±20 ppm
Input requirements	
Line rate tolerance	2.048 Mbps ±50 ppm
Signal level	+2 to -25 dB
Jitter tolerance	Conforms to ITU-T Recommendation G.823 (03/93), Section 3.1.1, Table 2.
Output Requirements	
Output level	2.37 volts into 75 ohms 3.0 volts into 120 ohms
Pulse shape	Conforms to ITU-T Recommendation G.703 (1991), Section 6.2, Figure 15.
Jitter generation	Conforms to ITU-T Recommendation G.824 (03/93), Section 2.1, Table 1.

Acronyms

The networking terms in the following list are defined in the Glossary of this user's manual. Glossary items are listed alphabetically according to the full term.

AAL	ATM Adaptation Layer
ABR	Available Bit Rate
ACM	Address Complete Message
ACR	Allowable Cell Rate
ADPCM	Adaptive Differential Pulse Code Modulation
AHFG	ATM-attached Host Functional Group
AIMUX	ATM Inverse Multiplexing
AIS	Alarm Indication Signal
AMI	Alternate Mark Inversion
AMI	ATM Management Interface
ANSI	American National Standards Institute
APCM	Adaptive Pulse Code Modulation
API	Application Program Interface
APP	Application Program
APS	Automatic Protection Switching
ARP	Address Resolution Protocol
ASCII	American Standard Code for Information Interchange
ATDM	Asynchronous Time Division Multiplexing
ATM	Asynchronous Transfer Mode
AUI	Attachment User Interface
B8ZS	Bipolar 8 Zero Substitution
BCOB	Broadband Connection Oriented Bearer
BCOB-A	Bearer Class A
BCOB-C	Bearer Class C
BCOB-X	Bearer Class X
BECN	Backward Explicit Congestion Notification
BER	Bit Error Rate
BES	Bursty Errored Seconds
BGP	Border Gateway Protocol
B-ICI	B-ISDN Inter-Carrier Interface.
BIP	Bit Interleaved Parity
B-ISDN	Broadband Integrated Services Digital Network
B-ISUP	Broadband ISDN User's Part

BITS	Building Integrated Timing Supply
BNC	Bayonet-Neill-Concelman
BPDU	Bridge Protocol Data Unit
bps	Bits per Second
BPV	Bipolar Violation
B-TE	Broadband Terminal Equipment
BUS	Broadcast and Unknown Server
CAC	Connection Admission Control
CAS	Channel Associated Signaling
CBDS	Connectionless Broadband Data Service
CBR	Constant Bit Rate
CCITT	International Telephone and Telegraph Consultative Committee
CCS	Common Channel Signaling
CDV	Cell Delay Variation
CE	Connection Endpoint
CEI	Connection Endpoint Identifier
CES	Circuit Emulation Service
CGA	Carrier Group Alarm
CIP	Carrier Identification Parameter
CIR	Committed Information Rate
CLIP	Classical IP
CLP	Cell Loss Priority
CLR	Cell Loss Ratio-1-15
CLS	Connectionless service
CMIP	Common Management Interface Protocol
CMR	Cell Misinsertion Rate
CPE	Customer Premise Equipment
CRA	Cell Rate Adaptation
CRC	Cyclic Redundancy Check
CRS	Cell Relay Service
CS	Controlled Slip, **or** Convergence Sublayer
CSU	Channel Service Unit
CTD	Cell Transfer Delay
CTS	Clear To Send
DACS	Digital Access and Cross-Connect System
DARPA	Defense Advanced Research Projects Agency
DCC	Data Country Code
DCE	Data Communications Equipment
DCS	Digital Cross-connect System
DES	Destination End Station
DFA	DXI Frame Address
DLCI	Data Link Connection Identifier

DNS	Domain Naming System
DSn	Digital Standard n (n=0, 1, 1C, 2, and 3)
DSR	Data Set Ready
DTE	Data Terminal Equipment
DTR	Data Terminal Ready
EEPROM	Electrically Erasable Programmable Read Only Memory
EFCI	Explicit Forward Congestion Indication
EGP	Exterior Gateway Protocol
EIA	Electronics Industries Association
EISA	Extended Industry Standard Architecture
ELAN	Emulated Local Area Network
EMI	Electromagnetic Interference
EPROM	Erasable Programmable Read Only Memory
EQL	Equalization
ER	Explicit Rate
ES	End System, **or** Errored Second
ESF	Extended Super Frame
ESI	End System Identifier
EXZ	Excessive Zeroes (Error Event)
FC	Face Contact
FCC	Federal Communications Commission
FCS	Frame Check Sequence
FDDI	Fiber Distributed Data Interface
FDM	Frequency Division Multiplexing
FEBE	Far End Block Error
FEC	Forward Error Correction
FECN	Forward Explicit Congestion Notification
FERF	Far End Receive Failure
FIFO	First-In, First-Out
FRS	Frame-Relay Service
FTP	File Transfer Protocol
FT-PNNI	ForeThought PNNI
FUNI	Frame-Based UNI
GCAC	Generic Connection Admission Control
GCRA	Generic Cell Rate Algorithm
GFC	Generic Flow Control
HDB3	High Density Bipolar
HDLC	High Level Data Link Control
HEC	Header Error Control
HIPPI	High Performance Parallel Interface
HSSI	High-Speed Serial Interface
ICMP	Internet Control Message Protocol

IDU	Interface Data Unit
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
ILMI	Interim Local Management Interface
IP	Internet Protocol
IPX	Internetwork Packet Exchange
IS	Intermediate system
ISDN	Integrated Services Digital Network
ISO	International Standards Organization
ITU-T	International Telecommunication Union Telecommunication
IWF	Interworking Function
IXC	Interexchange Carriers
JPEG	Joint Photographic Experts Group
Kbps	Kilobits per second
LAN	Local Area Network
LANE	LAN Emulation
LAPB	Link Access Procedure, Balanced
LATA	Local Access and Transport Area
LBO	Line Build Out
LCV	Line Code Violations
LE_ARP	LAN Emulation Address Resolution Protocol
LEC	LAN Emulation Client
LECS	LAN Emulation Configuration Server
LES	LAN Emulation Server
LLC	Logical Link Control
LOF	Loss Of Frame
LOP	Loss Of Pointer
LOS	Loss Of Signal
LSB	Least Significant Bit
MAC	Media Access Control
MAN	Metropolitan Area Network
MAU	Media Attachment Unit
MBS	Maximum Burst Size
MCDV	Maximum Cell Delay Variance
MCLR	Maximum Cell Loss Ratio
MCR	Minimum Cell Rate
MCTD	Maximum Cell Transfer Delay
MIB	Management Information Base
MIC	Media Interface Connector
MID	Message Identifier
MMF	Multimode Fiber Optic Cable
MPEG	Motion Picture Experts Group
MPOA	Multiprotocol over ATM

MSB	Most Significant Bit
MTU	Maximum Transmission Unit
NM	Network Management Entity
NML	Network Management Layer
NMS	Network Management Station
NNI	Network-to-Network Interface or Network Node Interface
NPC	Network Parameter Control
NRZ	Non Return to Zero
NRZI	Non Return to Zero Inverted
NSAP	Network Service Access Point
NTSC	National TV Standards Committee
OAM	Operation and Maintenance Cell
OC-n	Optical Carrier level-n
OID	Object Identifier
OOF	Out-of-Frame
OSI	Open Systems Interconnection
OSPF	Open Shortest Path First Protocol
OUI	Organizationally Unique Identifier
PAD	Packet Assembler Disassembler
PAL	Phase Alternate Line
PBX	Private Branch Exchange
PCI	Peripheral Component Interconnect
PCM	Pulse Code Modulation
PCR	Peak Cell Rate
PDN	Public Data Network
PDU	Protocol Data Unit
PHY	Physical Layer
ping	Packet Internet Groper
PLCP	Physical Layer Convergence Protocol
PLM	Physical Layer Module
PLP	Packet Level Protocol
PM	Physical Medium
PM	Physical Module
PMD	Physical Medium Dependent
PNNI	Private Network Node Interface or Private Network-to-Network Interface
PPP	Point-to-Point Protocol
PROM	Programmable Read-Only Memory
PRS	Primary Reference Source
PSN	Packet Switched Network
PT	Payload Type
PVC	Permanent Virtual Circuit (or Channel)
PVCC	Permanent Virtual Channel Connection
PVPC	Permanent Virtual Path Connection

QD	Queuing Delay
QoS	Quality of Service
RD	Routing Domain
RFCs	Requests For Comment
RFI	Radio Frequency Interference
RIP	Routing Information Protocol
RISC	Reduced Instruction Set Computer
RTS	Request To Send
SA	Source Address
SA	Source MAC Address
SAP	Service Access Point
SAR	Segmentation And Reassembly
SC	Structured Cabling, **or** Structured Connectors, **or** Stick and Click
SCR	Sustainable Cell Rate
SCSI	Small Computer Systems Interface
SDLC	Synchronous Data Link Control
SDU	Service Data Unit
SEAL	Simple and Efficient Adaptation Layer
SECAM	Systeme En Coleur Avec Memoire
SEL	Selector
SES	Severely Errored Seconds
SF	Super Frame
SGMP	Simple Gateway Management Protocol
SIR	Sustained Information Rate
SLIP	Serial Line IP
SMDS	Switched Multimegabit Data Service
SMF	Single Mode Fiber
SMTP	Simple Mail Transfer Protocol
SNA	Systems Network Architecture
SNAP	SubNetwork Access Protocol
SNI	Subscriber Network Interface
SNMP	Simple Network Management Protocol
SONET	Synchronous Optical Network
SPANS	Simple Protocol for ATM Network Signalling
SPARC	Scalable Processor Architecture Reduced instruction set Computer
SPE	Synchronous Payload Envelope
SPVC	Smart PVC
SS7	Signaling System No. 7
SSCOP	Service Specific Connection Oriented Protocol
SSCS	Service Specific Convergence Sublayer
ST	Straight Tip, **or**

	Stick and Turn
STM	Synchronous Transfer Mode
STP	Shielded Twisted Pair, Spanning Tree Protocol
STS	Synchronous Transport Signal
SVC	Switched Virtual Circuit (or Channel)
SVCC	Switched Virtual Channel Connection
SVPC	Switched Virtual Path Connection
TAXI	Transparent Asynchronous Transmitter / Receiver Interface
TC	Transmission Convergence
TCP	Transmission Control Protocol
TCP/IP	Transmission Control Protocol / Internet Protocol
TCR	Tagged Cell Rate
TCS	Transmission Convergence Sublayer
TDM	Time Division Multiplexing
TE	Terminal Equipment
TFTP	Trivial File Transfer Protocol
TM	Traffic Management
UAS	Unavailable Seconds
UBR	Unspecified Bit Rate
UDP	User Datagram Protocol
UNI	User-to-Network Interface
UPC	Usage Parameter Control
UTOPIA	Universal Test & Operations Interface for ATM
UTP	Unshielded Twisted Pair
VBR	Variable Bit Rate
VC	Virtual Channel (or Circuit)
VCC	Virtual Channel Connection
VCI	Virtual Channel Identifier
VCL	Virtual Channel Link
VINES	Virtual Network Software
VLAN	Virtual Local Area Network
VP	Virtual Path
VPC	Virtual Path Connection
VPDN	Virtual Private Data Network
VPI	Virtual Path Identifier
VPL	Virtual Path Link
VPN	Virtual Private Network
VPT	Virtual Path Terminator
VS/VD	Virtual Source / Virtual Destination
VT	Virtual Tributary
WAN	Wide-Area Network
ZBTSI	Zero Byte Time Slot Interchange

Glossary

10Base-T - a 10 Mbps baseband Ethernet specification utilizing twisted-pair cabling (Category 3, 4, or 5). 10BaseT, which is part of the IEEE 802.3 specification, has a distance limit of approximately 100 meters per segment.

802.1d Spanning Tree Bridging - the IEEE standard for bridging; a MAC layer standard for transparently connecting two or more LANs (often called subnetworks) that are running the same protocols and cabling. This arrangement creates an extended network, in which any two workstations on the linked LANs can share data.

802.3 Ethernet - the IEEE standard for Ethernet; a physical-layer standard that uses the CSMA/CD access method on a bus-topology LAN.

802.5 Token Ring - the IEEE physical-layer standard that uses the token-passing access method on a ring-topology LAN.

AAL Connection - an association established by the AAL between two or more next higher layer entities.

Adapter - A fitting that supplies a passage between two sets of equipment when they cannot be directly interconnected.

Adaptive Differential Pulse Code Modulation (ADPCM) - A technique that allows analog voice signals to be carried on a 32K bps digital channel. Sampling is done at 8Hz with 4 bits used to describe the difference between adjacent samples.

Adaptive Pulse Code Modulation (APCM) - A technique that effectively reduces occupied bandwidth per active speaker by reducing sampling rates during periods of overflow peak traffic.

Address - A unique identity of each network station on a LAN or WAN.

Address Complete Message (ACM) - A B-ISUP call control message from the receiving exchange to sending exchange indicating the completion of address information.

Address Mask - a bit mask used to identify which bits in an address (usually an IP address) are network significant, subnet significant, and host significant portions of the complete address. This mask is also known as the subnet mask because the subnetwork portion of the address can be determined by comparing the binary version of the mask to an IP address in that subnet. The mask holds the same number of bits as the protocol address it references.

Address Prefix - A string of 0 or more bits up to a maximum of 152 bits that is the lead portion of one or more ATM addresses.

Address Resolution - The procedure by which a client associates a LAN destination with the ATM address of another client or the BUS.

Address Resolution Protocol (ARP) - a method used to resolve higher level protocol addressing (such as IP) into the appropriate header data required for ATM; i.e., port, VPI, and VCI; also defines the AAL type to be used.

Agent - a component of network- and desktop-management software, such as SNMP, that gathers information from MIBs.

alarm - an unsolicited message from a device, typically indicating a problem with the system that requires attention.

Alarm Indication Signal (AIS) - In T1, an all ones condition used to alert a receiver that its incoming signal (or frame) has been lost. The loss of signal or frame is detected at the receiving end, and the failed signal is replaced by all the ones condition which the receiver interprets as an AIS. The normal response to this is AIS is for the receiving end to generate a yellow alarm signal as part of its transmission towards the faulty end. (The AIS itself is sometimes called a Blue Signal).

A-Law - The PCM coding and companding standard used in Europe.

Allowable Cell Rate (ACR) - parameter defined by the ATM Forum for ATM traffic management. ACR varies between the MCR and the PCR, and is dynamically controlled using congestion control mechanisms.

Alternate Mark Inversion (AMI) - A line coding format used on T1 facilities that transmits ones by alternate positive and negative pulses.

Alternate Routing - A mechanism that supports the use of a new path after an attempt to set up a connection along a previously selected path fails.

American National Standards Institute (ANSI) - a private organization that coordinates the setting and approval of some U.S. standards. It also represents the United States to the International Standards Organization.

American Standard Code for Information Interchange (ASCII) - a standard character set that (typically) assigns a 7-bit sequence to each letter, number, and selected control characters.

AppleTalk - a networking protocol developed by Apple Computer for communication between Apple's products and other computers. Independent of the network layer, AppleTalk runs on LocalTalk, EtherTalk and TokenTalk.

Application Layer - Layer seven of the ISO reference model; provides the end-user interface.

Application Program (APP) - a complete, self-contained program that performs a specific function directly for the user.

Application Program Interface (API) - a language format that defines how a program can be made to interact with another program, service, or other software; it allows users to develop custom interfaces with FORE products.

Assigned Cell - a cell that provides a service to an upper layer entity or ATM Layer Management entity (ATMM-entity).

asxmon - a FORE program that repeatedly displays the state of the switch and its active ports.

Asynchronous Time Division Multiplexing (ATDM) - a multiplexing technique in which a transmission capability is organized into a priori, unassigned time slots. The time slots are assigned to cells upon request of each application's instantaneous real need.

Asynchronous Transfer Mode (ATM) - a transfer mode in which the information is organized into cells. It is asynchronous in the sense that the recurrence of cells containing information from an individual user is not necessarily periodic.

ATM Adaptation Layer (AAL) - the AAL divides user information into segments suitable for packaging into a series of ATM cells. AAL layer types are used as follows:

AAL-1 - constant bit rate, time-dependent traffic such as voice and video
AAL-2 - still undefined; a placeholder for variable bit rate video transmission
AAL-3/4 - variable bit rate, delay-tolerant data traffic requiring some sequencing and/or error detection support (originally two AAL types, connection-oriented and connectionless, which have been combined)
AAL-5 - variable bit rate, delay-tolerant, connection-oriented data traffic requiring minimal sequencing or error detection support

ATM Address - Defined in the UNI Specification as 3 formats, each having 20 bytes in length.

ATM Forum - an international non-profit organization formed with the objective of accelerating the use of ATM products and services through a rapid convergence of interoperability specifications. In addition, the Forum promotes industry cooperation and awareness.

ATM Inverse Multiplexing (AIMUX) - A device that allows multiple T1 or E1 communications facilities to be combined into a single broadband facility for the transmission of ATM cells.

ATM Layer link - a section of an ATM Layer connection between two adjacent active ATM Layer entities (ATM-entities).

ATM Link - a virtual path link (VPL) or a virtual channel link (VCL).

ATM Management Interface (AMI) - the user interface to FORE Systems' *ForeThought* switch control software (SCS). AMI lets users monitor and change various operating configurations of FORE Systems switches and network module hardware and software, IP connectivity, and SNMP network management.

ATM Peer-to-Peer Connection - a virtual channel connection (VCC) or a virtual path connection (VPC) directly established, such as workstation-to-workstation. This setup is not commonly used in networks.

ATM Port - One of the two ports on a bridge on the *Cellpath* 300. The ATM port is internal and passes data between the bridge and the ATM cell bus. The ATM connections can be thought of as emanating from the ATM port.

ATM Traffic Descriptor - a generic list of parameters that can be used to capture the intrinsic traffic characteristics of a requested ATM connection.

ATM User-to-User Connection - an association established by the ATM Layer to support communication between two or more ATM service users (i.e., between two or more next higher layer entities or between two or more ATM entities). The communication over an ATM Layer connection may be either bidirectional or unidirectional. The same Virtual Channel Identifier (VCI) is used for both directions of a connection at an interface.

atmarp - a FORE program that shows and manipulates ATM ARP entries maintained by the given device driver. This is also used to establish PVC connections.

ATM-attached Host Functional Group (AHFG) - The group of functions performed by an ATM-attached host that is participating in the MPOA service.

atmconfig - a FORE program used to enable or disable SPANS signaling.

atmstat - a FORE program that shows statistics gathered about a given adapter card by the device driver. These statistics include ATM layer and ATM adaptation layer cell and error counts. This can also be used to query other hosts via SNMP.

Attachment User Interface (AUI) - IEEE 802.3 interface between a media attachment unit (MAU) and a network interface card (NIC). The term AUI can also refer to the rear panel port to which an AUI cable might attach.

Auto-logout - a feature that automatically logs out a user if there has been no user interface activity for a specified length of time.

Automatic Protection Switching (APS) - Equipment installed in communications systems to detect circuit failures and automatically switch to redundant, standby equipment.

Available Bit Rate (ABR) - a type of traffic for which the ATM network attempts to meet that traffic's bandwidth requirements. It does not guarantee a specific amount of bandwidth and the end station must retransmit any information that did not reach the far end.

Backbone - the main connectivity device of a distributed system. All systems that have connectivity to the backbone connect to each other, but systems can set up private arrangements with each other to bypass the backbone to improve cost, performance, or security.

Backplane - High-speed communications line to which individual components are connected.

Backward Explicit Congestion Notification (BECN) - A Resource Management cell type generated by the network or the destination, indicating congestion or approaching congestion for traffic flowing in the direction opposite that of the BECN cell.

Bandwidth - usually identifies the capacity or amount of data that can be sent through a given circuit; may be user-specified in a PVC.

Baud - unit of signalling speed, equal to the number of discrete conditions or signal events per second. If each signal event represents only one bit, the baud rate is the same as bps; if each signal event represents more than one bit (such as a dibit), the baud rate is smaller than bps.

Bayonet-Neill-Concelman (BNC) - a bayonet-locking connector used to terminate coaxial cables. BNC is also referred to as Bayonet Network Connector.

Bipolar 8 Zero Substitution (B8ZS) - a technique used to satisfy the ones density requirements of digital T-carrier facilities in the public network while allowing 64 Kbps clear channel data. Strings of eight consecutive zeroes are replaced by an eight-bit code representing two intentional bipolar pulse code violations (000V10V1).

Bipolar Violation (BPV) - an error event on a line in which the normal pattern of alternating high (one) and low (zero) signals is disrupted. A bipolar violation is noted when two high signals occur without an intervening low signal, or vice versa.

B-ISDN Inter-Carrier Interface (B-ICI) - An ATM Forum defined specification for the interface between public ATM networks to support user services across multiple public carriers.

Bit Error Rate (BER) - A measure of transmission quality, generally shown as a negative exponent, (e.g., 10^{-7} which means 1 out of 10^{7} bits [1 out of 10,000,000 bits] are in error).

Bit Interleaved Parity (BIP) - an error-detection technique in which character bit patterns are forced into parity, so that the total number of one bits is always odd or always even. This is accomplished by the addition of a one or zero bit to each byte, as the byte is transmitted; at the other end of the transmission, the receiving device verifies the parity (odd or even) and the accuracy of the transmission.

Bit Robbing - The use of the least significant bit per channel in every sixth frame for signaling.

Bit Stuffing - A process in bit-oriented protocols where a zero is inserted into a string of ones by the sender to prevent the receiver from interpreting valid user data (the string of ones) as control characters (a Flag character for instance).

Border Gateway Protocol (BGP) - used by gateways in an internet connecting autonomous networks. It is derived from experiences learned using the EGP.

bps - bits per second

Bridge - a device that expands a Local Area Network by forwarding frames between data link layers associated with two separate cables, usually carrying a common protocol. Bridges can usually be made to filter certain packets (to forward only certain traffic).

Bridge Protocol Data Unit (BPDU) - A message type used by bridges to exchange management and control information.

Broadband - a service or system requiring transmission channels capable of supporting rates greater than the Integrated Services Digital Network (ISDN) primary rate.

Broadband Access - an ISDN access capable of supporting one or more broadband services.

Broadband Connection Oriented Bearer (BCOB) - Information in the SETUP message that indicates the type of service requested by the calling user.

BCOB-A (Bearer Class A) - Indicated by ATM end user in SETUP message for connection-oriented, constant bit rate service. The network may perform internetworking based on AAL information element (IE).

BCOB-C (Bearer Class C) - Indicated by ATM end user in SETUP message for connection-oriented, variable bit rate service. The network may perform internetworking based on AAL information element (IE).

BCOB-X (Bearer Class X) - Indicated by ATM end user in SETUP message for ATM transport service where AAL, traffic type and timing requirements are transparent to the network.

bridge group - Bridges on the *Cellpath* 300 that are connected over the ATM network using virtual connections are said to be in the same bridge group.

Broadband Integrated Services Digital Network (B-ISDN) - a common digital network suitable for voice, video, and high-speed data services running at rates beginning at 155 Mbps.

Broadband ISDN User's Part (B-ISUP) - A protocol used to establish, maintain and release broadband switched network connections across an SS7 / ATM network.

Broadband Terminal Equipment (B-TE) - An equipment category for B-ISDN which includes terminal adapters and terminals.

Broadcast - Data transmission to all addresses or functions.

Broadcast and Unknown Server (BUS) - in an emulated LAN, the BUS is responsible for accepting broadcast, multicast, and unknown unicast packets from the LECs to the broadcast MAC address (FFFFFFFFFFFF) via dedicated point-to-point connections, and forwarding the packets to all of the members of the ELAN using a single point-to-multipoint connection.

Brouter (bridging/router) - a device that routes some protocols and bridges others based on configuration information.

Buffer - A data storage medium used to compensate of a difference in rate of data flow or time of occurrence of events when transmitting data from one device to another.

Building Integrated Timing Supply (BITS) - a master timing supply for an entire building, which is a master clock and its ancillary equipment. The BITS supplies DS1 and / or composite clock timing references for synchronization to all other clocks and timing sources in that building.

Bursty Errored Seconds (BES) - a BES contains more than 1 and fewer than 320 path coding violation error events, and no severely errored frame or AIS defects. Controlled slips are not included in determining BESs.

Bursty Second - a second during which there were at least the set number of BES threshold event errors but fewer than the set number of SES threshold event errors.

Byte - A computer-readable group of bits (normally 8 bits in length).

Call - an association between two or more users or between a user and a network entity that is established by the use of network capabilities. This association may have zero or more connections.

Carrier - a company, such as any of the "baby Bell" companies, that provide network communications services, either within a local area or between local areas.

Carrier Group Alarm (CGA) - A service alarm generated by a channel bank when an out-of-frame (OOF) condition exists for some predetermined length of time (generally 300 milliseconds to 2.5 seconds). The alarm causes the calls using a trunk to be dropped and trunk conditioning to be applied.

Carrier Identification Parameter (CIP) - A 3 or 4 digit code in the initial address message identifying the carrier to be used for the connection.

cchan - a FORE program that manages virtual channels on a *ForeRunner* switch running asxd.

Cell - an ATM Layer protocol data unit (PDU). The basic unit of information transported in ATM technology, each 53-byte cell contains a 5-byte header and a 48-byte payload.

cell bus - The means by which data is passed between ports on a *CellPath* 300. All traffic on the cell bus is in ATM cells.

Cell Delay Variation (CDV) - a quantification of cell clumping for a connection. The cell clumping CDV (yk) is defined as the difference between a cell's expected reference arrival time (ck) and its actual arrival time (ak). The expected reference arrival time (ck) of cell k of a specific connection is max. T is the reciprocal of the negotiated peak cell rate.

Cell Delineation - the protocol for recognizing the beginning and end of ATM cells within the raw serial bit stream.

Cell Header - ATM Layer protocol control information.

Cell Loss Priority (CLP) - the last bit of byte four in an ATM cell header; indicates the eligibility of the cell for discard by the network under congested conditions. If the bit is set to 1, the cell may be discarded by the network depending on traffic conditions.

Cell Loss Ratio - In a network, cell loss ratio is (1-x / y), where y is the number of cells that arrive in an interval at an ingress of the network; and x is the number of these y cells that leave at the egress of the network element.

Cell Loss Ratio (CLR) - CLR is a negotiated QoS parameter and acceptable values are network specific. The objective is to minimize CLR provided the end-system adapts the traffic to the changing ATM layer transfer characteristics. The Cell Loss Ratio is defined for a connection as: Lost Cells / Total Transmitted Cells. The CLR parameter is the value of CLR that the network agrees to offer as an objective over the lifetime of the connection. It is expressed as an order of magnitude, having a range of 10-1 to 10-15 and unspecified.

Cell Misinsertion Rate (CMR) - the ratio of cells received at an endpoint that were not originally transmitted by the source end in relation to the total number of cells properly transmitted.

Cell Rate Adaptation (CRA) - a function performed by a protocol module in which empty cells (known as unassigned cells) are added to the output stream. This is because there always must be a fixed number of cells in the output direction; when there are not enough cells to transmit, unassigned cells are added to the output data stream.

Cell Relay Service (CRS) - a carrier service which supports the receipt and transmission of ATM cells between end users in compliance with ATM standards and implementation specifications.

Cell Transfer Delay - the transit delay of an ATM cell successfully passed between two designated boundaries. See CTD.

Cell Transfer Delay (CTD) - This is defined as the elapsed time between a cell exit event at the measurement point 1 (e.g., at the source UNI) and the corresponding cell entry event at the measurement point 2 (e.g., the destination UNI) for a particular connection. The cell transfer delay between two measurement points is the sum of the total inter-ATM node transmission delay and the total ATM node processing delay.

Channel - A path or circuit along which information flows.

Channel Associated Signaling (CAS) - a form of circuit state signaling in which the circuit state is indicated by one or more bits of signaling status sent repetitively and associated with that specific circuit.

Channel Bank - A device that multiplexes many slow speed voice or data conversations onto high speed link and controls the flow.

Channel Service Unit (CSU) - An interface for digital leased lines which performs loopback testing and line conditioning.

Channelization - capability of transmitting independent signals together over a cable while still maintaining their separate identity for later separation.

Circuit - A communications link between points.

Circuit Emulation Service (CES) - The ATM Forum circuit emulation service interoperability specification specifies interoperability agreements for supporting Constant Bit Rate (CBR) traffic over ATM networks that comply with the other ATM Forum interoperability agreements. Specifically, this specification supports emulation of existing TDM circuits over ATM networks.

Classical IP (CLIP) - IP over ATM which conforms to RFC 1577.

Clear to Send (CTS) - and RS-232 modem interface control signal (sent from the modem to the DTE on pin 5) which indicates that the attached DTE may begin transmitting; issuance in response to the DTE's RTS.

Clocking - Regularly timed impulses.

Closed User Group - A subgroup of network users that can be its own entity; any member of the subgroup can only communicate with other members of that subgroup.

Coaxial Cable - Coax is a type of electrical communications medium used in the LAN environment. This cable consists of an outer conductor concentric to an inner conductor, separated from each other by insulating material, and covered by some protective outer material. This medium offers large bandwidth, supporting high data rates with high immunity to electrical interference and a low incidence of errors. Coax is subject to distance limitations and is relatively expensive and difficult to install.

Cold Start Trap - an SNMP trap which is sent after a power-cycle (see *trap*).

Collision - Overlapping transmissions that occur when two or more nodes on a LAN attempt to transmit at or about the same time.

Committed Information Rate (CIR) - CIR is the information transfer rate which a network offering Frame Relay Services (FRS) is committed to transfer under normal conditions. The rate is averaged over a minimum increment of time.

Common Channel Signaling (CCS) - A form signaling in which a group of circuits share a signaling channel. Refer to SS7.

Common Management Interface Protocol (CMIP) - An ITU-TSS standard for the message formats and procedures used to exchange management information in order to operate, administer maintain and provision a network.

Concatenation - The connection of transmission channels similar to a chain.

Concentrator - a communications device that offers the ability to concentrate many lower-speed channels into and out of one or more high-speed channels.

Configuration - The phase in which the LE Client discovers the LE Service.

Congestion Management - traffic management feature that helps ensure reasonable service for VBR connections in an ATM network, based on a priority, sustained cell rate (SCR), and peak cell rate (PCR). During times of congestion, bandwidth is reduced to the SCR, based on the priority of the connection.

Connection - the concatenation of ATM Layer links in order to provide an end-to-end information transfer capability to access points.

Connection Admission Control (CAC) - the procedure used to decide if a request for an ATM connection can be accepted based on the attributes of both the requested connection and the existing connections.

Connection Endpoint (CE) - a terminator at one end of a layer connection within a SAP.

Connection Endpoint Identifier (CEI) - an identifier of a CE that can be used to identify the connection at a SAP.

Connectionless Broadband Data Service (CBDS) - A connectionless service similar to Bellcore's SMDS defined by European Telecommunications Standards Institute (ETSI).

Connectionless Service - a type of service in which no pre-determined path or link has been established for transfer of information, supported by AAL 4.

Connectionless Service (CLS) - A service which allows the transfer of information among service subscribers without the need for end-to- end establishment procedures.

Connection-Oriented Service - a type of service in which information always traverses the same pre-established path or link between two points, supported by AAL 3.

Constant Bit Rate (CBR) - a type of traffic that requires a continuous, specific amount of bandwidth over the ATM network (e.g., digital information such as video and digitized voice).

Controlled Slip (CS) - a situation in which one frame's worth of data is either lost or replicated. A controlled slip typically occurs when the sending device and receiving device are not using the same clock.

Convergence Sublayer (CS) - a portion of the AAL. Data is passed first to the CS where it is divided into rational, fixed-length packets or PDUs (Protocol Data Units). For example, AAL 4 processes user data into blocks that are a maximum of 64 kbytes long.

Corresponding Entities - peer entities with a lower layer connection among them.

cpath - a FORE program used to manage virtual paths on a *ForeRunner* switch running asxd.

cport - a FORE program that monitors and changes the state of ports on a *ForeRunner* switch running asxd.

cross connect - The mapping of a VPI/VCI to another VPI/VCI within the *CellPath* 300 that connects two virtual connections. A cross connect is sometimes referred to simply as a "connection."

Cross Connection - a mapping between two channels or paths at a network device.

Customer Premise Equipment (CPE) - equipment that is on the customer side of the point of demarcation, as opposed to equipment that is on a carrier side. See also point of demarcation.

Cut Through - Establishment of a complete path for signaling and/or audio communications.

Cyclic Redundancy Check (CRC) - an error detection scheme in which a number is derived from the data that will be transmitted. By recalculating the CRC at the remote end and comparing it to the value originally transmitted, the receiving node can detect errors.

D3/D4 - Refers to compliance with AT&T TR (Technical Reference) 62411 definitions for coding, supervision, and alarm support. D3/D4 compatibility ensures support of digital PBXes, M24 services, Megacom services, and Mode 3 D3/D4 channel banks at DS-1 level.

D4 Channelization - refers to compliance with AT&T Technical Reference 62411 regarding DS1 frame layout (the sequential assignment of channels and time slot numbers within the DS1).

D4 Framed/Framing Format - in T1, a 193-bit frame format in which the 193rd bit is used for framing and signaling information (the frame/framing bit). To be considered in support of D4 Framing, a device must be able to synchronize and frame-up on the 193rd bit.

Data Communications Equipment (DCE) - a definition in the RS232C standard that describes the functions of the signals and the physical characteristics of an interface for a communication device such as a modem.

Data Country Code (DCC) - This specifies the country in which an address is registered. The codes are given in ISO 3166. The length of this field is two octets. The digits of the data country code are encoded in Binary Coded Decimal (BCD) syntax. The codes will be left justified and padded on the right with the hexadecimal value "F" to fill the two octets.

Data Link - Communications connection used to transmit data from a source to a destination.

Data Link Connection Identifier (DLCI) - connection identifier associated with frame relay packets that serves the same functions as, and translates directly to, the VPI / VCI on an ATM cell.

Data Link Layer - Layer 2 of the OSI model, responsible for encoding data and passing it to the physical medium. The IEEE divides this layer into the LLC (Logical Link Control) and MAC (Media Access Control) sublayers.

Data Set Ready (DSR) - an RS-232 modem interface control signal (sent from the modem to the DTE on pin 6) which indicates that the modem is connected to the telephone circuit. Usually a prerequisite to the DTE issuing RTS.

Data Terminal Equipment (DTE) - generally user devices, such as terminals and computers, that connect to data circuit-terminating equipment. They either generate or receive the data carried by the network.

Data Terminal Ready (DTR) - an RS232 modem interface control signal (sent from the DTE to the modem on pin 20) which indicates that the DTE is ready for data transmission and which requests that the modem be connected to the telephone circuit.

Datagram - a packet of information used in a connectionless network service that is routed to its destination using an address included in the datagram's header.

DECnet - Digital Equipment Corporation's proprietary LAN.

Defense Advanced Research Projects Agency (DARPA) - the US government agency that funded the ARPANET.

Demultiplexing - a function performed by a layer entity that identifies and separates SDUs from a single connection to more than one connection (see *multiplexing*).

Destination End Station (DES) - An ATM termination point which is the destination for ATM messages of a connection and is used as a reference point for ABR services. See SES.

Digital Access and Cross-Connect System (DACS) - Digital switching system for routing T1 lines, and DS-0 portions of lines, among multiple T1 ports.

Digital Cross-connect System (DCS) - an electronic patch panel used to route digital signals in a central office.

Digital Standard n (0, 1, 1C, 2, and 3) (DSn) - a method defining the rate and format of digital hierarchy, with asynchronous data rates defined as follows:

DS0	64kb / s	1 voice channel
DS1	1.544Mb / s	24 DS0s
DS1C	3.152 Mb / s	2 DS1s
DS2	6.312 Mb / s	4 DS1s
DS3	44.736 Mb / s	28 DS1s

Synchronous data rates (SONET) are defined as:

STS-1 / OC-1	51.84 Mb / s	28 DS1s or 1 DS3

STS-3 / OC-3	155.52 Mb / s	3 STS-1s byte interleaved
STS-3c / OC-3c	155.52 Mb / s	Concatenated, indivisible payload
STS-12 / OC-12	622.08 Mb / s	12 STS-1s, 4 STS-3cs, or any mixture
STS-12c / OC-12c	622.08 Mb / s	Concatenated, indivisible payload
STS-48 / OC-48	2488.32 Mb / s	48 STS-1s, 16 STS-3cs, or any mixture

DIP (Dual In-line Package) Switch - a device that has two parallel rows of contacts that let the user switch electrical current through a pair of those contacts to on or off. They are used to reconfigure components and peripherals.

Domain Name Server - a computer that converts names to their corresponding Internet numbers. It allows users to telnet or FTP to the name instead of the number.

Domain Naming System (DNS) - the distributed name and address mechanism used in the Internet.

Duplex - Two way communication.

DXI - a generic phrase used in the full names of several protocols, all commonly used to allow a pair of DCE and DTE devices to share the implementation of a particular WAN protocol. The protocols define the packet formats used to transport data between DCE and DTE devices.

DXI Frame Address (DFA) - a connection identifier associated with ATM DXI packets that serves the same functions as, and translates directly to, the VPI / VCI on an ATM cell.

Dynamic Allocation - A technique in which the resources assigned for program execution are determined by criteria applied at the moment of need.

E.164 - A public network addressing standard utilizing up to a maximum of 15 digits. ATM uses E.164 addressing for public network addressing.

E1 - Wide-area digital transmission scheme used predominantly in Europe that carries data at a rate of 2.048 Mbps. E1 lines can be leased for private use from common carriers.

E3 - Wide-area digital transmission scheme used predominantly in Europe that carries data at a rate of 34.368 Mbps. E3 lines can be leased for private use from common carriers.

Edge Device - A physical device which is capable of forwarding packets between legacy interworking interfaces (e.g., Ethernet, Token Ring, etc.) and ATM interfaces based on data-link and network layer information but which does not participate in the running of any network layer routing protocol. An Edge Device obtains forwarding descriptions using the route distribution protocol.

elarp - a FORE program that shows and manipulates MAC and ATM address mappings for LAN Emulation Clients (LECs).

elconfig - a FORE program that shows and modifies LEC configuration. Lets the user set the NSAP address of the LAN Emulation Configuration Server, display the list of Emulated LANs configured in the LECS for this host, display the list of ELANs locally configured along with the membership state of each, and locally administer ELAN membership.

Electrically Erasable Programmable Read Only Memory (EEPROM) - an EPROM that can be cleared with electrical signals rather than the traditional ultraviolet light.

Electromagnetic Interference (EMI) - signals generated and radiated by an electronic device that cause interference with radio communications, among other effects.

Electronics Industries Association (EIA) - a USA trade organization that issues its own standards and contributes to ANSI; developed RS-232. Membership includes USA manufacturers.

Embedded SNMP Agent - an SNMP agent can come in two forms: embedded or proxy. An embedded SNMP agent is integrated into the physical hardware and software of the unit.

Emulated Local Area Network (ELAN) - A logical network initiated by using the mechanisms defined by LAN Emulation. This could include ATM and legacy attached end stations.

End System (ES) - a system where an ATM connection is terminated or initiated (an originating end system initiates the connection; a terminating end system terminates the connection).

End System Identifier (ESI) - This identifier distinguishes multiple nodes at the same level in case the lower level peer group is partitioned.

End-to-End Connection - when used in reference to an ATM network, a connection that travels through an ATM network, passing through various ATM devices and with endpoints at the termination of the ATM network.

Enterprise - Terminology generally referring to customers with multiple, non-contiguous geographic locations.

Equalization (EQL) - the process of compensating for line distortions.

Erasable Programmable Read Only Memory (EPROM) - A PROM which may be erased and rewritten to perform new or different functions (normally done with a PROM burner).

Errored Second (ES) - a second during which at least one code violation occurred.

Ethernet - a 10-Mbps, coaxial standard for LANs in which all nodes connect to the cable where they contend for access.

Ethernet port - One of the two ports on a bridge on the *CellPath* 300. The Ethernet port is visible on the back panel of the *CellPath* 300 and is where the Ethernet segment connects to the bridge.

Ethernet segment - An Ethernet subnetwork.

Excessive Zeroes (EXZ) Error Event - An Excessive Zeroes error event for an AMI-coded signal is the occurrence of more than fifteen contiguous zeroes. For a B8ZS coded signal, the defect occurs when more than seven contiguous zeroes are detected.

Explicit Forward Congestion Indication (EFCI) - the second bit of the payload type field in the header of an ATM cell, the EFCI bit indicates network congestion to receiving hosts. On a congested switch, the EFCI bit is set to “1” by the transmitting network module when a certain number of cells have accumulated in the network module's shared memory buffer. When a cell is received that has its EFCI bit set to “1,” the receiving host notifies the sending host, which should then reduce its transmission rate.

Explicit Rate (ER) - The Explicit Rate is an RM-cell field used to limit the source ACR to a specific value. It is initially set by the source to a requested rate (such as PCR). It may be subsequently reduced by any network element in the path to a value that the element can sustain. ER is formatted as a rate.

Extended Industry Standard Architecture (EISA) - bus architecture for desktop computers that provides a 32-bit data passage and maintains compatibility with the ISA or AT architecture.

Extended Super Frame (ESF) - a T1 framing format that utilizes the 193rd bit as a framing bit, but whose Superframe is made up of 24 frames instead of 12 as in D4 format. ESF also provides CRC error detection and maintenance data link functions.

Exterior Gateway Protocol (EGP) - used by gateways in an internet, connecting autonomous networks.

Fairness - related to Generic Flow Control, fairness is defined as meeting all of the agreed quality of service requirements by controlling the order of service for all active connections.

Far End Block Error (FEBE) - an error detected by extracting the 4-bit FEBE field from the path status byte (G1). The legal range for the 4-bit field is between 0000 and 1000, representing zero to eight errors. Any other value is interpreted as zero errors.

Far End Receive Failure (FERF) - a line error asserted when a 110 binary pattern is detected in bits 6, 7, 8 of the K2 byte for five consecutive frames. A line FERF is removed when any pattern other than 110 is detected in these bits for five consecutive frames.

Far-End - in a relationship between two devices in a circuit, the far-end device is the one that is remote.

Face Contact (FC) - Designation for fiber optic connector designed by Nippon Telegraph and Telephone which features a movable anti-rotation key allowing good repeatable performance despite numerous mating. Normally referred to as Fiber Connector, FC actually stands for Face Contact and sometimes linked with PC (Point Contact), designated as FC or FC-PC.

FCC Part 68 - The FCC rules regulating the direct connection of non-telephone company provided equipment to the public telephone network.

Federal Communications Commission (FCC) - a board of commissioners appointed by the President under the Communications Act of 1934, with the authority to regulate all interstate telecommunications originating in the United States, including transmission over phone lines.

Fiber Distributed Data Interface (FDDI) - high-speed data network that uses fiber-optic as the physical medium. Operates in similar manner to Ethernet or Token Ring, only faster.

File Transfer Protocol (FTP) - a TCP/IP protocol that lets a user on one computer access, and transfer data to and from, another computer over a network. ftp is usually the name of the program the user invokes to accomplish this task.

First-In, First-Out (FIFO) - method of coordinating the sequential flow of data through a buffer.

Flag - a bit pattern of six binary "1"s bounded by a binary "0" at each end (forms a 0111 1110 or Hex "7E"). It is used to mark the beginning and/or end of a frame.

Flow Control - The way in which information is controlled in a network to prevent loss of data when the receiving buffer is near its capacity.

***ForeThought* PNNI (FT-PNNI) -** a FORE Systems routing and signalling protocol that uses private ATM (NSAP) addresses; a precursor to ATM Forum PNNI (see PNNI).

Forward Error Correction (FEC) - A technique used by a receiver for correcting errors incurred in transmission over a communications channel without requiring retransmission of any information by the transmitter; typically involves a convolution of the transmitted bits and the appending of extra bits by both the receiver and transmitter using a common algorithm.

Forward Explicit Congestion Notification (FECN) - Bit set by a Frame Relay network to inform data terminal equipment (DTE) receiving the frame that congestion was experienced in the path from source to destination. DTE receiving frames with the FECN bit set can request that higher-level protocols take flow control action as appropriate.

forwarding database - A database that determines which port on the bridge, or which ATM connection, a packet should be forwarded to. The database is created by the bridges learning function, and can also include entries made by the user that discards packets destined for specific addresses.

Fractional T1 - the use of bandwidth in 64Kbps increments up to 1.544Mbps from a T1 facility.

Frame - a variable length group of data bits with a specific format containing flags at the beginning and end to provide demarcation.

Frame Check Sequence (FCS) - In bit-oriented protocols, a 16-bit field that contains transmission error checking information, usually appended to the end of the frame.

Frame Relay - a fast packet switching protocol based on the LAPD protocol of ISDN that performs routing and transfer with less overhead processing than X.25.

Frame Synchronization Error - an error in which one or more time slot framing bits are in error.

Frame-Based UNI (FUNI) - An ATM switch-based interface which accepts frame-based ATM traffic and converts it into cells.

Frame-Relay Service (FRS) - A connection oriented service that is capable of carrying up to 4096 bytes per frame.

Framing - a protocol that separates incoming bits into identifiable groups so that the receiving multiplexer recognizes the grouping.

Frequency Division Multiplexing (FDM) - a method of dividing an available frequency range into parts with each having enough bandwidth to carry one channel.

Gbps - gigabits per second (billion)

Generic Cell Rate Algorithm (GCRA) - an algorithm which is employed in traffic policing and is part of the user / network service contract. The GCRA is a scheduling algorithm which ensures that cells are marked as conforming when they arrive when expected or later than expected and non-conforming when they arrive sooner than expected.

Generic Connection Admission Control (GCAC) - This is a process to determine if a link has potentially enough resources to support a connection.

Generic Flow Control (GFC) - the first four bits of the first byte in an ATM cell header. Used to control the flow of traffic across the User-to-Network Interface (UNI), and thus into the network. Exact mechanisms for flow control are still under investigation and no explicit definition for this field exists at this time. (This field is used only at the UNI; for NNI-NNI use (between network nodes), these four bits provide additional network address capacity, and are appended to the VPI field.)

GIO - a proprietary bus architecture used in certain Silicon Graphics, Inc. workstations.

Header - protocol control information located at the beginning of a protocol data unit.

Header Error Control (HEC) - a CRC code located in the last byte of an ATM cell header that is used for checking cell header integrity only.

High Density Bipolar (HDB3) - A bipolar coding method that does not allow more than 3 consecutive zeroes.

High Level Data Link Control (HDLC) - An ITU-TSS link layer protocol standard for point-to-point and multi-point communications.

High Performance Parallel Interface (HIPPI) - ANSI standard that extends the computer bus over fairly short distances at speeds of 800 and 1600 Mbps.

High-Speed Serial Interface (HSSI) - a serial communications connection that operates at speeds of up to 1.544 Mbps.

Host - In a network, the primary or controlling computer in a multiple computer installation.

HPUX - the Hewlett-Packard version of UNIX.

Hub - a device that connects several other devices, usually in a star topology.

I/O Module - FORE's interface cards for the LAX-20 LAN Access Switch, designed to connect Ethernet, Token Ring, and FDDI LANs to *ForeRunner* ATM networks.

Institute of Electrical and Electronics Engineers (IEEE) - the world's largest technical professional society. Based in the U.S., the IEEE sponsors technical conferences, symposia & local meetings worldwide, publishes nearly 25% of the world's technical papers in electrical, electronics & computer engineering, provides educational programs for members, and promotes standardization.

IEEE 802 - Standards for the interconnection of LAN computer equipment. Deals with the Data Link Layers of the ISO Reference Model for OSI.
IEEE 802.1 - Defines the high-level network interfaces such as architecture, internetworking and network management.
IEEE 802.2 - Defines the Logical Link Control interface between the Data Link and Network Layers.
IEEE 802.3 - Defines CSMA / CD (Ethernet).
IEEE 802.4 - Defines the token-passing bus.

IEEE 802.5 - Defines the Token Ring access methodology. This standard incorporates IBM's Token Ring specifications.
IEEE 802.6 - Defines Metropolitan Area Networks.
IEEE 802.7 - The broadband technical advisory group.
IEEE 802.8 - The fiber optics technical advisory group.
IEEE 802.9 - Defines integrated data and voice networks.

Integrated Services Digital Network (ISDN) - an emerging technology that is beginning to be offered by the telephone carriers of the world. ISDN combines voice and digital network services into a single medium or wire.

Interexchange Carriers (IXC) - Long-distance communications companies that provide service between Local Access Transport Areas (LATAs).

Interface Data - the unit of information transferred to/from the upper layer in a single interaction across a SAP. Each Interface Data Unit (IDU) controls interface information and may also contain the whole or part of the SDU.

Interface Data Unit (IDU) - The unit of information transferred to/from the upper layer in a single interaction across the SAP. Each IDU contains interface control information and may also contain the whole or part of the SDU.

Interim Local Management Interface (ILMI) - the standard that specifies the use of the Simple Network Management Protocol (SNMP) and an ATM management information base (MIB) to provide network status and configuration information.

Intermediate System (IS) - a system that provides forwarding functions or relaying functions or both for a specific ATM connection. OAM cells may be generated and received.

International Standards Organization (ISO) - a voluntary, non treaty organization founded in 1946 that is responsible for creating international standards in many areas, including computers and communications.

International Telephone and Telegraph Consultative Committee (CCITT) - the international standards body for telecommunications.

Internet - (note the capital "I") the largest internet in the world including large national backbone nets and many regional and local networks worldwide. The Internet uses the TCP/IP suite. Networks with only e-mail connectivity are not considered on the Internet.

internet - while an internet is a network, the term "internet" is usually used to refer to a collection of networks interconnected with routers.

Internet Addresses - the numbers used to identify hosts on an internet network. Internet host numbers are divided into two parts; the first is the network number and the second, or local, part is a host number on that particular network. There are also three classes of networks in the Internet, based on the number of hosts on a given network. Large networks are classified as Class A, having addresses in the range 1-126 and having a maximum of 16,387,064 hosts. Medium networks are classified as Class B, with addresses in the range 128-191 and with a maximum of 64,516 hosts. Small networks are classified as Class C, having addresses in the range 192-254 with a maximum of 254 hosts. Addresses are given as dotted decimal numbers in the following format:

nnn.nnn.nnn.nnn

In a Class A network, the first of the numbers is the network number, the last three numbers are the local host address.

In a Class B network, the first two numbers are the network, the last two are the local host address.

In a Class C network, the first three numbers are the network address, the last number is the local host address.

The following table summarizes the classes and sizes:

Class	First #	Max# Hosts
A	1-126	16,387,064
B	129-191	64,516
C	192-223	254

Network mask values are used to identify the network portion and the host portion of the address. Default network masks are as follows:

Class A - 255.0.0.0

Class B - 255.255.0.0

Class C - 255.255.255.0

Subnet masking is used when a portion of the host ID is used to identify a subnetwork. For example, if a portion of a Class B network address is used for a subnetwork, the mask could be set as 255.255.255.0. This would allow the third byte to be used as a subnetwork address. All hosts on the network would still use the IP address to get on the Internet.

Internet Control Message Protocol (ICMP) - the protocol that handles errors and control messages at the IP layer. ICMP is actually a part of the IP protocol layer. It can generate error messages, test packets, and informational messages related to IP.

Internet Engineering Task Force (IETF) - a large, open, international community of network designers, operators, vendors and researchers whose purpose is to coordinate the operation, management and evolution of the Internet to resolve short- and mid-range protocol and architectural issues.

Internet Protocol (IP) - a connectionless, best-effort packet switching protocol that offers a common layer over dissimilar networks.

Internetwork Packet Exchange (IPX) Protocol - a NetWare protocol similar to the Xerox Network Systems (XNS) protocol that provides datagram delivery of messages.

Interoperability - The ability of software and hardware on multiple machines, from multiple vendors, to communicate.

Interworking Function (IWF) - provides a means for two different technologies to interoperate.

IP Address - a unique 32-bit integer used to identify a device in an IP network. You will most commonly see IP addresses written in "dot" notation (e.g., 192.228.32.14).

IP Netmask - a 32-bit pattern that is combined with an IP address to determine which bits of an IP address denote the network number and which denote the host number. Netmasks are useful for sub-dividing IP networks. IP netmasks are written in "dot" notation (e.g., 255.255.0.0).

ISA Bus - a bus standard developed by IBM for expansion cards in the first IBM PC. The original bus supported a data path only 8 bits wide. IBM subsequently developed a 16-bit version for its AT class computers. The 16-bit AT ISA bus supports both 8- and 16-bit cards. The 8-bit bus is commonly called the PC / XT bus, and the 16-bit bus is called the AT bus.

Isochronous - signals carrying embedded timing information or signals that are dependent on uniform timing; usually associated with voice and / or video transmission.

International Telecommunications Union Telecommunications (ITU-T) - an international body of member countries whose task is to define recommendations and standards relating to the international telecommunications industry. The fundamental standards for ATM have been defined and published by the ITU-T (Previously CCITT).

J2 - Wide-area digital transmission scheme used predominantly in Japan that carries data at a rate of 6.312 Mbps.

Jitter - analog communication line distortion caused by variations of a signal from its reference timing position.

Joint Photographic Experts Group (JPEG) - An ISO Standards group that defines how to compress still pictures.

Jumper - a patch cable or wire used to establish a circuit, often temporarily, for testing or diagnostics; also, the devices, shorting blocks, used to connect adjacent exposed pins on a printed circuit board that control the functionality of the card.

Kbps - kilobits per second (thousand)

LAN Access Concentrator - a LAN access device that allows a shared transmission medium to accommodate more data sources than there are channels currently available within the transmission medium.

LAN Emulation Address Resolution Protocol (LE_ARP) - A message issued by a LE client to solicit the ATM address of another function.

LAN Emulation Client (LEC) - the component in an end system that performs data forwarding, address resolution, and other control functions when communicating with other components within an ELAN.

LAN Emulation Configuration Server (LECS) - the LECS is responsible for the initial configuration of LECs. It provides information about available ELANs that a LEC may join, together with the addresses of the LES and BUS associated with each ELAN.

LAN Emulation Server (LES) - the LES implements the control coordination function for an ELAN by registering and resolving MAC addresses to ATM addresses.

LAN Emulation (LANE) - technology that allows an ATM network to function as a LAN backbone. The ATM network must provide multicast and broadcast support, address mapping (MAC-to-ATM), SVC management, and a usable packet format. LANE also defines Ethernet and Token Ring ELANs.

lane - a program that provides control over the execution of the LAN Emulation Server (LES), Broadcast / Unknown Server (BUS), and LAN Emulation Configuration Server (LECS) on the local host.

Latency - The time interval between a network station seeking access to a transmission channel and that access being granted or received.

Layer Entity - an active layer within an element.

Layer Function - a part of the activity of the layer entities.

Layer Service - a capability of a layer and the layers beneath it that is provided to the upper layer entities at the boundary between that layer and the next higher layer.

Layer User Data - the information transferred between corresponding entities on behalf of the upper layer or layer management entities for which they are providing services.

le - a FORE program that implements both the LAN Emulation Server (LES) and the Broadcast / Unknown Server (BUS).

Leaky Bucket - informal cell policing term for the Generic Cell Rate Algorithm which in effect receives cells into a bucket and leaks them out at the specified or contracted rate (i.e., PCR).

learning process - The means by which a learning bridge determines the most direct way to forward packets toward their destination.

Least Significant Bit (LSB) - lowest order bit in the binary representation of a numerical value.

lecs - a FORE program that implements the assignment of individual LECs to different emulated LANs.

leq - a FORE program that provides information about an ELAN. This information is obtained from the LES, and includes MAC addresses registered on the ELAN together with their corresponding ATM addresses.

Line Build Out (LBO) - Because T1 circuits require the last span to lose 15-22.5 dB, a selectable output attenuation is generally required of DTE equipment (typical selections include 0.0, 7.5 and 15 dB of loss at 772 KHz).

Line Code Violations (LCV) - Error Event. A Line Coding Violation (LCV) is the occurrence of either a Bipolar Violation (BPV) or Excessive Zeroes (EXZ) Error Event.

Link - An entity that defines a topological relationship (including available transport capacity) between two nodes in different subnetworks. Multiple links may exist between a pair of subnetworks. Synonymous with logical link.

Link Access Procedure, Balanced (LAPB) - Data link protocol in the X.25 protocol stack. LAPB is a bit-oriented protocol derived from HDLC. See also HDLC and X.25.

Link Down Trap - an SNMP trap, sent when an interface changes from a normal state to an error state, or is disconnected.

Link Layer - layer in the OSI model regarding transmission of data between network nodes.

Link Up Trap - an SNMP trap, sent when an interface changes from an error condition to a normal state.

Load Sharing - Two or more computers in a system that share the load during peak hours. During periods of non peak hours, one computer can manage the entire load with the other acting as a backup.

Local Access and Transport Area (LATA) - Geographic boundaries of the local telephone network, specified by the FCC, in which a single LEC may perform its operations. Communications outside or between LATAs are provided by IXCs.

Local Area Network (LAN) - a data network intended to serve an area of only a few square kilometers or less. Because the network is known to cover only a small area, optimizations can be made in the network signal protocols that permit higher data rates.

Logical Link Control (LLC) - protocol developed by the IEEE 802 committee for data-link-layer transmission control; the upper sublayer of the IEEE Layer 2 (OSI) protocol that complements the MAC protocol; IEEE standard 802.2; includes end-system addressing and error checking.

Loopback - a troubleshooting technique that returns a transmitted signal to its source so that the signal can be analyzed for errors. Typically, a loopback is set at various points in a line until the section of the line that is causing the problem is discovered.

looptest - program that tests an interface for basic cell reception and transmission functionality, usually used for diagnostic purposes to determine if an interface is functioning properly.

Loss Of Frame (LOF) - a type of transmission error that may occur in wide-area carrier lines.

Loss Of Pointer (LOP) - a type of transmission error that may occur in wide-area carrier lines.

Loss Of Signal (LOS) - a type of transmission error that may occur in wide-area carrier lines, or a condition declared when the DTE senses a loss of a DS1 signal from the CPE for more the 150 milliseconds (the DTE generally responds with an all ones “Blue or AIS” signal).

Management Information Base (MIB) - the set of parameters that an SNMP management station can query or set in the SNMP agent of a networked device (e.g., router).

Maximum Burst Size (MBS) - the Burst Tolerance (BT) is conveyed through the MBS which is coded as a number of cells. The BT together with the SCR and the GCRA determine the MBS that may be transmitted at the peak rate and still be in conformance with the GCRA.

Maximum Burst Tolerance - the largest burst of data that a network device is guaranteed to handle without discarding cells or packets. Bursts of data larger than the maximum burst size may be subject to discard.

Maximum Cell Delay Variance (MCDV) - This is the maximum two-point CDV objective across a link or node for the specified service category.

Maximum Cell Loss Ratio (MCLR) - This is the maximum ratio of the number of cells that do not make it across the link or node to the total number of cells arriving at the link or node.

Maximum Cell Transfer Delay (MCTD) - This is the sum of the fixed delay component across the link or node and MCDV.

Maximum Transmission Unit (MTU) - the largest unit of data that can be sent over a type of physical medium.

Mbps - megabits per second (million)

Media Access Control (MAC) - a media-specific access control protocol within IEEE 802 specifications; currently includes variations for Token Ring, token bus, and CSMA/CD; the lower sublayer of the IEEE's link layer (OSI), which complements the Logical Link Control (LLC).

Media Attachment Unit (MAU) - device used in Ethernet and IEEE 802.3 networks that provides the interface between the AUI port of a station and the common medium of the Ethernet. The MAU, which can be built into a station or can be a separate device, performs physical layer functions including conversion of the digital data from the Ethernet interface, collision detection, and injection of bits onto the network.

Media Interface Connector (MIC) - fiber optic connector that joins fiber to the FDDI controller.

mesh - A set of connections that link objects in a group in an every-to-every-other configuration.

Message Identifier (MID) - message identifier used to associate ATM cells that carry segments from the same higher layer packet.

Metasignalling - an ATM Layer Management (LM) process that manages different types of signalling and possibly semipermanent virtual channels (VCs), including the assignment, removal, and checking of VCs.

Metasignalling VCs - the standardized VCs that convey metasignalling information across a User-to-Network Interface (UNI).

Metropolitan Area Network (MAN) - network designed to carry data over an area larger than a campus such as an entire city and its outlying area.

MicroChannel - a proprietary 16- or 32-bit bus developed by IBM for its PS/2 computers' internal expansion cards; also offered by others.

Minimum Cell Rate (MCR) - parameter defined by the ATM Forum for ATM traffic management, defined only for ABR transmissions and specifying the minimum value for the ACR.

Most Significant Bit (MSB) - highest order bit in the binary representation of a numerical value.

Motion Picture Experts Group (MPEG) - ISO group dealing with video and audio compression techniques and mechanisms for multiplexing and synchronizing various media streams.

MPOA Client - A device which implements the client side of one or more of the MPOA protocols, (i.e., is a SCP client and/or an RDP client. An MPOA Client is either an Edge Device Functional Group (EDFG) or a Host Behavior Functional Group (HBFG).

MPOA Server - An MPOA Server is any one of an ICFG or RSFG.

MPOA Service Area - The collection of server functions and their clients. A collection of physical devices consisting of an MPOA server plus the set of clients served by that server.

MPOA Target - A set of protocol address, path attributes, (e.g., internetwork layer QoS, other information derivable from received packet) describing the intended destination and its path attributes that MPOA devices may use as lookup keys.

Mu-Law - The PCM coding and companding standard used in Japan and North America.

multicast connection - An ATM connection characterized by a root and leaves, where traffic splits at the root and is sent to each leaf. In other words, the same traffic has a single source but multiple destinations. Multicast connections are unidirectional, carrying traffic only in the root-to-leaf direction.

Multicasting - The ability to broadcast messages to one node or a select group of nodes.

Multi-homed - a device having both an ATM and another network connection, like Ethernet.

Multimode Fiber Optic Cable (MMF) - fiber optic cable in which the signal or light propagates in multiple modes or paths. Since these paths may have varying lengths, a transmitted pulse of light may be received at different times and smeared to the point that pulses may interfere with surrounding pulses. This may cause the signal to be difficult or impossible to receive. This pulse dispersion sometimes limits the distance over which a MMF link can operate.

Multiplexing - a function within a layer that interleaves the information from multiple connections into one connection (see demultiplexing).

Multipoint Access - user access in which more than one terminal equipment (TE) is supported by a single network termination.

Multipoint-to-Multipoint Connection - a collection of associated ATM VC or VP links, and their associated endpoint nodes, with the following properties:

1. All N nodes in the connection, called Endpoints, serve as a Root Node in a Point-to-Multipoint connection to all of the (N-1) remaining endpoints.

2. Each of the endpoints can send information directly to any other endpoint, but the receiving endpoint cannot distinguish which of the endpoints is sending information without additional (e.g., higher layer) information.

Multipoint-to-Point Connection - a Point-to-Multipoint Connection may have zero bandwidth from the Root Node to the Leaf Nodes, and non-zero return bandwidth from the Leaf Nodes to the Root Node. Such a connection is also known as a Multipoint-to-Point Connection.

Multiprotocol over ATM (MPOA) - An effort taking place in the ATM Forum to standardize protocols for the purpose of running multiple network layer protocols over ATM.

Narrowband Channel - sub-voicegrade channel with a speed range of 100 to 200 bps.

National TV Standards Committee (NTSC) - Started in the US in 1953 from a specification laid down by the National Television Standards Committee. It takes the B-Y and R-Y color difference signals, attenuates them to I and Q, then modulates them using double-sideband suppressed subcarrier at 3.58MHz. The carrier reference is sent to the receiver as a burst during the back porch. An industry group that defines how television signals are encoded and transmitted in the US. (See also PAL, SECAM for non-U.S. countries).

Near-End - in a relationship between two devices in a circuit, the near-end device is the one that is local.

Network Layer - Layer three In the OSI model, the layer that is responsible for routing data across the network.

Network Management Entity (NM) - body of software in a switching system that provides the ability to manage the PNNI protocol. NM interacts with the PNNI protocol through the MIB.

Network Management Layer (NML) - an abstraction of the functions provided by systems which manage network elements on a collective basis, providing end-to-end network monitoring.

Network Management Station (NMS) - system responsible for managing a network or portion of a network by talking to network management agents, which reside in the managed nodes.

Network Module - ATM port interface cards which may be individually added to or removed from any *ForeRunner* ATM switch to provide a diverse choice of connection alternatives.

Network Parameter Control (NPC) - Defined as the set of actions taken by the network to monitor and control traffic from the NNI. Its main purpose is to protect network resources from malicious as well as unintentional misbehavior which can affect the QoS of other already established connections by detecting violations of negotiated parameters and taking appropriate actions. Refer to UPC.

Network Redundancy - Duplicated network equipment and/or data which can provide a backup in case of network failures.

Network Service Access Point (NSAP) - OSI generic standard for a network address consisting of 20 octets. ATM has specified E.164 for public network addressing and the NSAP address structure for private network addresses.

Network-to-Network Interface or Network Node Interface (NNI) - the interface between two public network pieces of equipment.

Node - A computer or other device when considered as part of a network.

Non Return to Zero (NRZ) - a binary encoding scheme in which ones and zeroes are represented by opposite and alternating high and low voltages and where there is no return to a zero (reference) voltage between encoded bits.

Non Return to Zero Inverted (NRZI) - A binary encoding scheme that inverts the signal on a "1" and leaves the signal unchanged for a "0". (Also called transition encoding.)

Nonvolatile Storage - Memory storage that does not lose its contents when power is turned off.

NuBus - a high-speed bus used in Macintosh computers, structured so users can put a card into any slot on the board without creating conflict over the priority between those cards.

nx64K - This refers to a circuit bandwidth or speed provided by the aggregation of nx64 kbps channels (where n= integer > 1). The 64K or DS0 channel is the basic rate provided by the T Carrier systems.

Nyquist Theorem - In communications theory, a formula stating that two samples per cycle is sufficient to characterize a bandwidth limited analog signal; in other words, the sampling rate must be twice the highest frequency component of the signal (i.e., sample 4 KHz analog voice channels 8000 times per second).

Object Identifier (OID) - the address of a MIB variable.

Octet - a grouping of 8 bits; similar, but not identical to, a byte.

One's Density - The requirement for digital transmission lines in the public switched telephone network that eight consecutive "0"s cannot be in a digital data stream; exists because repeaters and clocking devices within the network will lose timing after receiving eight "0"s in a row; a number of techniques are used to insert a "1" after every seventh-consecutive "0" (see Bit Stuffing).

Open Shortest Path First (OSPF) Protocol - a routing algorithm for IP that incorporates least-cost, equal-cost, and load balancing.

Open Systems Interconnection (OSI) - the 7-layer suite of protocols designed by ISO committees to be the international standard computer network architecture.

OpenView - Hewlett-Packard's network management software.

Operation and Maintenance (OAM) Cell - a cell that contains ATM LM information. It does not form part of the upper layer information transfer.

Optical Carrier level-n (OC-n) - The optical counterpart of STS-n (the basic rate of 51.84 Mbps on which SONET is based is referred to as OC-1 or STS-1).

Organizationally Unique Identifier (OUI) - Part of RFC 1483. A three-octet field in the SubNetwork Attachment Point (SNAP) header, identifying an organization which administers the meaning of the following two octet Protocol Identifier (PID) field in the SNAP header. Together they identify a distinct routed or bridged protocol.

Out-of-Band Management - refers to switch configuration via the serial port or over Ethernet, not ATM.

Out-of-Frame (OOF) - a signal condition and alarm in which some or all framing bits are lost.

Packet - An arbitrary collection of data grouped and transmitted with its user identification over a shared facility.

Packet Assembler Disassembler (PAD) - interface device that buffers data sent to/from character mode devices, and assembles and disassembles the packets needed for X.25 operation.

Packet Internet Groper (ping) - a program used to test reachability of destinations by sending them an ICMP echo request and waiting for a reply.

Packet Level Protocol (PLP) - Network layer protocol in the X.25 protocol stack. Sometimes called X.25 Level 3 or X.25 Protocol.

Packet Switched Network (PSN) - a network designed to carry data in the form of packets. The packet and its format is internal to that network.

Packet Switching - a communications paradigm in which packets (messages) are individually routed between hosts with no previously established communications path.

Payload Scrambling - a technique that eliminates certain bit patterns that may occur within an ATM cell payload that could be misinterpreted by certain sensitive transmission equipment as an alarm condition.

Payload Type (PT) - bits 2...4 in the fourth byte of an ATM cell header. The PT indicates the type of information carried by the cell. At this time, values 0...3 are used to identify various types of user data, values 4 and 5 indicate management information, and values 6 and 7 are reserved for future use.

Peak Cell Rate - at the PHY Layer SAP of a point-to-point VCC, the Peak Cell Rate is the inverse of the minimum inter-arrival time T0 of the request to send an ATM-SDU.

Peak Cell Rate (PCR) - parameter defined by the ATM Forum for ATM traffic management. In CBR transmissions, PCR determines how often data samples are sent. In ABR transmissions, PCR determines the maximum value of the ACR.

Peer Entities - entities within the same layer.

Peripheral Component Interconnect (PCI) - a local-bus standard created by Intel.

Permanent Virtual Channel Connection (PVCC) - A Virtual Channel Connection (VCC) is an ATM connection where switching is performed on the VPI/VCI fields of each cell. A Permanent VCC is one which is provisioned through some network management function and left up indefinitely.

Permanent Virtual Circuit (or Channel) (PVC) - a circuit or channel through an ATM network provisioned by a carrier between two endpoints; used for dedicated long-term information transport between locations.

Permanent Virtual Path Connection (PVPC) - A Virtual Path Connection (VPC) is an ATM connection where switching is performed on the VPI field only of each cell. A PVPC is one which is provisioned through some network management function and left up indefinitely.

Phase Alternate Line (PAL) - Largely a German/British development in the late 60s, used in the UK and much of Europe. The B-Y and R-Y signals are weighted to U and V, then modulated onto a double-sideband suppressed subcarrier at 4.43MHz. The V (R-Y) signal's phase is turned through 180 degrees on each alternate line. This gets rid of NTSC's hue changes with phase errors at the expense of de-saturation. The carrier reference is sent as a burst in the back porch. The phase of the burst is alternated every line to convey the phase switching of the V signal. The burst's average phase is -V. (see NTSC for U.S.).

Physical Layer (PHY) - the actual cards, wires, and/or fiber-optic cabling used to connect computers, routers, and switches.

Physical Layer Connection - an association established by the PHY between two or more ATM-entities. A PHY connection consists of the concatenation of PHY links in order to provide an end-to-end transfer capability to PHY SAPs.

Physical Layer Convergence Protocol (PLCP) - a framing protocol that runs on top of the T1 or E1 framing protocol.

Physical Layer Module (PLM) - The circuit board in the *CellPath* 300 that provides the logic to support the physical layer in a *CellPath* 300. The PLM mates with a PM to form a module pair. *See also PM*.

Physical Medium (PM) - Refers to the actual physical interfaces. Several interfaces are defined including STS-1, STS-3c, STS-12c, STM-1, STM-4, DS1, E1, DS2, E3, DS3, E4, FDDI-based, Fiber Channel-based, and STP. These range in speeds from 1.544Mbps through 622.08 Mbps.

Physical Medium Dependent (PMD) - a sublayer concerned with the bit transfer between two network nodes. It deals with wave shapes, timing recovery, line coding, and electro-optic conversions for fiber based links.

Plesiochronous - two signals are plesiochronous if their corresponding significant instants occur at nominally the same rate, with variations in rate constrained to specified limits.

Point of Demarcation - the dividing line between a carrier and the customer premise that is governed by strict standards that define the characteristics of the equipment on each side of the demarcation. Equipment on one side of the point of demarcation is the responsibility of the customer. Equipment on the other side of the point of demarcation is the responsibility of the carrier.

Point-to-Multipoint Connection - a collection of associated ATM VC or VP links, with associated endpoint nodes, with the following properties:

1. One ATM link, called the Root Link, serves as the root in a simple tree topology. When the Root node sends information, all of the remaining nodes on the connection, called Leaf nodes, receive copies of the information.

2. Each of the Leaf Nodes on the connection can send information directly to the Root Node. The Root Node cannot distinguish which Leaf is sending information without additional (higher layer) information. (See the following note for Phase 1.)

3. The Leaf Nodes cannot communicate directly to each other with this connection type.

Note: Phase 1 signalling does not support traffic sent from a Leaf to the Root.

Point-to-Point Connection - a connection with only two endpoints.

Point-to-Point Protocol (PPP) - Provides a method for transmitting packets over serial point-to-point links.

Policing - the function that ensures that a network device does not accept traffic that exceeds the configured bandwidth of a connection.

Port Identifier - The identifier assigned by a logical node to represent the point of attachment of a link to that node.

Presentation Layer - Sixth layer of the OSI model, providing services to the application layer.

Primary Reference Source (PRS) - Equipment that provides a timing signal whose long-term accuracy is maintained at 1 x 10 -11 or better with verification to universal coordinated time (UTC) and whose timing signal is used as the basis of reference for the control of other clocks within a network.

Primitive - an abstract, implementation-independent interaction between a layer service user and a layer service provider.

Priority - the parameter of ATM connections that determines the order in which they are reduced from the peak cell rate (PCR) to the sustained cell rate (SCR) in times of congestion. Connections with lower priority (4 is low, 1 is high) are reduced first.

Private Branch Exchange (PBX) - a private phone system (switch) that connects to the public telephone network and offers in-house connectivity. To reach an outside line, the user must dial a digit like 8 or 9.

Private Network Node Interface or Private Network-to-Network Interface (PNNI) - a protocol that defines the interaction of private ATM switches or groups of private ATM switches

Programmable Read-Only Memory (PROM) - a chip-based information storage area that can be recorded by an operator but erased only through a physical process.

Protocol - a set of rules and formats (semantic and syntactic) that determines the communication behavior of layer entities in the performance of the layer functions.

Protocol Control Information - the information exchanged between corresponding entities using a lower layer connection to coordinate their joint operation.

Protocol Data Unit (PDU) - a unit of data specified in a layer protocol and consisting of protocol control information and layer user data.

Protocol Module (PM) - The circuit board in the *CellPath* 300 that provides the logic to support the protocol layer in a *CellPath* 300. The PM mates with the PLM to form a module pair. *See also PLM*.

Proxy - the process in which one system acts for another system to answer protocol requests.

Proxy Agent - an agent that queries on behalf of the manager, used to monitor objects that are not directly manageable.

Public Data Network (PDN) - a network designed primarily for data transmission and intended for sharing by many users from many organizations.

Pulse Code Modulation (PCM) - a modulation scheme that samples the information signals and transmits a series of coded pulses to represent the data.

Q.2931 - Derived from Q.93B, the narrowband ISDN signalling protocol, an ITU standard describing the signalling protocol to be used by switched virtual circuits on ATM LANs.

Quality of Service (QoS) - Quality of Service is defined on an end-to-end basis in terms of the following attributes of the end-to-end ATM connection:

Cell Loss Ratio
Cell Transfer Delay
Cell Delay Variation

Queuing Delay (QD) - refers to the delay imposed on a cell by its having to be buffered because of unavailability of resources to pass the cell onto the next network function or element. This buffering could be a result of oversubscription of a physical link, or due to a connection of higher priority or tighter service constraints getting the resource of the physical link.

Radio Frequency Interference (RFI) - the unintentional transmission of radio signals. Computer equipment and wiring can both generate and receive RFI.

Real-Time Clock - a clock that maintains the time of day, in contrast to a clock that is used to time the electrical pulses on a circuit.

Red Alarm - In T1, a red alarm is generated for a locally detected failure such as when a condition like OOF exists for 2.5 seconds, causing a CGA, (Carrier Group Alarm).

Reduced Instruction Set Computer (RISC) - a generic name for CPUs that use a simpler instruction set than more traditional designs.

Redundancy - In a data transmission, the fragments of characters and bits that can be eliminated with no loss of information.

Registration - The address registration function is the mechanism by which Clients provide address information to the LAN Emulation Server.

Relaying - a function of a layer by means of which a layer entity receives data from a corresponding entity and transmits it to another corresponding entity.

remote access port - The port that provides a way to connect bridges on different *CellPath* 300 devices, especially *CellPath* 300 devices that are geographically remote. This would typically be an ATM UNI port.

Request To Send (RTS) - an RS-232 modem interface signal (sent from the DTE to the modem on pin 4) which indicates that the DTE has data to transmit.

Requests For Comment (RFCs) - IETF documents suggesting protocols and policies of the Internet, inviting comments as to the quality and validity of those policies. These comments are collected and analyzed by the IETF in order to finalize Internet standards.

RFC1483 - Multiprotocol Encapsulation over ATM Adaptation Layer 5.
RFC1490 - Multiprotocol Interconnect over Frame Relay.
RFC1577 - Classical IP and ARP over ATM.
RFC1755 - ATM Signaling Support for IP over ATM.

Robbed-Bit Signaling - In T1, refers to the use of the least significant bit of every word of frames 6 and 12 (D4), or 6, 12, 18, and 24 (ESF) for signaling purposes.

Route Server - A physical device that runs one or more network layer routing protocols, and which uses a route query protocol in order to provide network layer routing forwarding descriptions to clients.

Router - a device that forwards traffic between networks or subnetworks based on network layer information.

Routing Domain (RD) - A group of topologically contiguous systems which are running one instance of routing.

Routing Information Protocol (RIP) - a distance vector-based protocol that provides a measure of distance, or hops, from a transmitting workstation to a receiving workstation.

Routing Protocol - A general term indicating a protocol run between routers and/or route servers in order to exchange information used to allow computation of routes. The result of the routing computation will be one or more forwarding descriptions.

SBus - hardware interface for add-in boards in later-version Sun 3 workstations.

Scalable Processor Architecture Reduced instruction set Computer (SPARC) - a powerful workstation similar to a reduced-instruction-set-computing (RISC) workstation.

Segment - a single ATM link or group of interconnected ATM links of an ATM connection.

Segmentation And Reassembly (SAR) - the SAR accepts PDUs from the CS and divides them into very small segments (44 bytes long). If the CS-PDU is less than 44 bytes, it is padded to 44 with zeroes. A two-byte header and trailer are added to this basic segment. The header identifies the message type (beginning, end, continuation, or single) and contains sequence numbering and message identification. The trailer gives the SAR-PDU payload length, exclusive of pad, and contains a CRC check to ensure the SAR-PDU integrity. The result is a 48-byte PDU that fits into the payload field of an ATM cell.

Selector (SEL) - A subfield carried in SETUP message part of ATM endpoint address Domain specific Part (DSP) defined by ISO 10589, not used for ATM network routing, used by ATM end systems only.

Semipermanent Connection - a connection established via a service order or via network management.

Serial Line IP (SLIP) - A protocol used to run IP over serial lines, such as telephone circuits or RS-232 cables, interconnecting two systems.

Service Access Point (SAP) - the point at which an entity of a layer provides services to its LM entity or to an entity of the next higher layer.

Service Data Unit (SDU) - a unit of interface information whose identity is preserved from one end of a layer connection to the other.

Service Specific Connection Oriented Protocol (SSCOP) - an adaptation layer protocol defined in ITU-T Specification: Q.2110.

Service Specific Convergence Sublayer (SSCS) - The portion of the convergence sublayer that is dependent upon the type of traffic that is being converted.

Session Layer - Layer 5 in the OSI model that is responsible for establishing and managing sessions between the application programs running in different nodes.

Severely Errored Seconds (SES) - a second during which more event errors have occurred than the SES threshold (normally 10-3).

Shaping Descriptor - *n* ordered pairs of GCRA parameters (I,L) used to define the negotiated traffic shape of an APP connection. The traffic shape refers to the load-balancing of a network, where load-balancing means configuring data flows to maximize network efficiency.

Shielded Pair - Two insulated wires in a cable wrapped with metallic braid or foil to prevent interference and provide noise free transmission.

Shielded Twisted Pair (STP) - two or more insulated wires, twisted together and then wrapped in a cable with metallic braid or foil to prevent interference and offer noise-free transmissions.

Signaling System No. 7 (SS7) - The SS7 protocol has been specified by ITU-T and is a protocol for interexchange signaling.

Simple and Efficient Adaptation Layer (SEAL) - also called AAL 5, this ATM adaptation layer assumes that higher layer processes will provide error recovery, thereby simplifying the SAR portion of the adaptation layer. Using this AAL type packs all 48 bytes of an ATM cell information field with data. It also assumes that only one message is crossing the UNI at a time. That is, multiple end-users at one location cannot interleave messages on the same VC, but must queue them for sequential transmission.

Simple Gateway Management Protocol (SGMP) - the predecessor to SNMP.

Simple Mail Transfer Protocol (SMTP) - the Internet electronic mail protocol used to transfer electronic mail between hosts.

Simple Network Management Protocol (SNMP) - the Internet standard protocol for managing nodes on an IP network.

Simple Protocol for ATM Network Signalling (SPANS) - FORE Systems' proprietary signalling protocol used for establishing SVCs between FORE Systems equipment.

Single Mode Fiber (SMF) - Fiber optic cable in which the signal or light propagates in a single mode or path. Since all light follows the same path or travels the same distance, a transmitted pulse is not dispersed and does not interfere with adjacent pulses. SMF fibers can support longer distances and are limited mainly by the amount of attenuation. Refer to MMF.

Small Computer Systems Interface (SCSI) - a standard for a controller bus that connects hardware devices to their controllers on a computer bus, typically used in small systems.

Smart PVC (SPVC) - a generic term for any communications medium which is permanently provisioned at the end points, but switched in the middle. In ATM, there are two kinds of SPVCs: smart permanent virtual path connections (SPVPCs) and smart permanent virtual channel connections (SPVCCs).

snmpd - an SMNP agent for a given adapter card.

Source - Part of communications system which transmits information.

Source Address (SA) - The address from which the message or data originated.

Source MAC Address (SA) - A six octet value uniquely identifying an end point and which is sent in an IEEE LAN frame header to indicate source of frame.

Source Traffic Descriptor - a set of traffic parameters belonging to the ATM Traffic Descriptor used during the connection set-up to capture the intrinsic traffic characteristics of the connection requested by the source.

Spanning Tree Protocol - A protocol that prevents loops in the LAN (and subsequent packet storms) by blocking bridge ports in a bridge to create a spanning tree.

Static Route - a route that is entered manually into the routing table.

station - In the context of an Ethernet LAN, station refers to a device that can be the ultimate source and destination of Ethernet packets, and that is uniquely identified by a MAC address. A device on the Ethernet segment that transmits and receives Ethernet packets.

Statistical Multiplexing - a technique for allowing multiple channels and paths to share the same link, typified by the ability to give the bandwidth of a temporarily idle channel to another channel.

Stick and Click (SC) - Designation for an Optical Connector featuring a 2.5 mm physically contacting ferrule with a push-pull mating design. Commonly referred to as Structured Cabling, Structured Connectors or Stick and Click

Stick and Turn (ST) - A fiber-optic connector designed by AT&T which uses the bayonet style coupling rather than screw-on as the SMA uses. The ST is generally considered the eventual replacement for the SMA type connector.

Store-and-Forward - the technique of receiving a message, storing it until the proper outgoing line is available, then retransmitting it, with no direct connection between incoming and outgoing lines.

Straight Tip (ST) - see *Stick and Turn*.

Structured Cabling (SC) - see *Stick and Click.*

Structured Connectors (SC) - see *Stick and Click.*

Sublayer - a logical subdivision of a layer.

SubNetwork Access Protocol (SNAP) - a specially reserved variant of IEEE 802.2 encoding SNAP indicates to look further into the packet where it will fine a Type field.

Subscriber Network Interface (SNI) - the interface between an SMDS end user's CPE and the network directly serving the end user, supported by either a DS1 or DS3 access arrangement.

Super Frame (SF) - a term used to describe the repeating 12 D4 frame format that composes a standard (non-ESF) T1 service.

Super User - a login ID that allows unlimited access to the full range of a device's functionality, including especially the ability to reconfigure the device and set passwords.

Sustainable Cell Rate (SCR) - ATM Forum parameter defined for traffic management. For VBR connections, SCR determines the long-term average cell rate that can be transmitted.

Sustained Information Rate (SIR) - In ATM this refers to the long-term average data transmission rate across the User-to-Network Interface. In SMDS this refers to the committed information rate (similar to CIR for Frame Relay Service).

Switch - Equipment used to interconnect lines and trunks.

Switched Connection - A connection established via signaling.

Switched Multimegabit Data Service (SMDS) - a high-speed, datagram-based, public data network service expected to be widely used by telephone companies in their data networks.

Switched Virtual Channel Connection (SVCC) - A Switched VCC is one which is established and taken down dynamically through control signaling. A Virtual Channel Connection (VCC) is an ATM connection where switching is performed on the VPI/VCI fields of each cell.

Switched Virtual Circuit (or Channel) (SVC) - a channel established on demand by network signalling, used for information transport between two locations and lasting only for the duration of the transfer; the datacom equivalent of a dialed telephone call.

Switched Virtual Path Connection (SVPC) - a connection which is established and taken down dynamically through control signaling. A Virtual Path Connection (VPC) is an ATM connection where switching is performed on the VPI field only of each cell.

Switching System - A set of one or more systems that act together and appear as a single switch for the purposes of PNNI routing.

Symmetric Connection - a connection with the same bandwidth specified for both directions.

Synchronous - signals that are sourced from the same timing reference and hence are identical in frequency.

Synchronous Data Link Control (SDLC) - IBM's data link protocol used in SNA networks.

Synchronous Optical Network (SONET) - a body of standards that defines all aspects of transporting and managing digital traffic over optical facilities in the public network.

Synchronous Payload Envelope (SPE) - the payload field plus a little overhead of a basic SONET signal.

Synchronous Transfer Mode (STM) - a transport and switching method that depends on information occurring in regular, fixed patterns with respect to a reference such as a frame pattern.

Synchronous Transport Signal (STS) - a SONET electrical signal rate.

Systeme En Coleur Avec Memoire (SECAM) - Sequential and Memory Color Television - Started in France in the late 60s, and used by other countries with a political affiliation. This is. The B-Y and R-Y signals are transmitted on alternate lines modulated on an FM subcarrier. The memory is a one line delay line in the receiver to make both color difference signals available at the same time on all lines. Due to FM, the signal is robust in difficult terrain.

Systems Network Architecture (SNA) - a proprietary networking architecture used by IBM and IBM-compatible mainframe computers.

T1 - a specification for a transmission line. The specification details the input and output characteristics and the bandwidth. T1 lines run at 1.544 Mbps and provide for 24 data channels. In common usage, the term “T1” is used interchangeably with “DS1.”

T1 Link - A wideband digital carrier facility used for transmission of digitized voice, digital data, and digitized image traffic. This link is composed of two twisted-wire pairs that can carry 24 digital channels, each operating at 64K bps at the aggregate rate of 1.544M bps, full duplex. Also referred to as DS-1.

T3 - a specification for a transmission line, the equivalent of 28 T1 lines. T3 lines run at 44.736 Mbps. In common usage, the term “T3” is used interchangeably with “DS3.”

Tachometer - in *ForeView*, the tachometer shows the level of activity on a given port. The number in the tachometer shows the value of a chosen parameter in percentage, with a colored bar providing a semi-logarithmic representation of that percentage.

Tagged Cell Rate (TCR) - An ABR service parameter, TCR limits the rate at which a source may send out-of-rate forward RM-cells. TCR is a constant fixed at 10 cells / second.

Telephony - The conversion of voices and other sounds into electrical signals which are then transmitted by telecommunications media.

Telnet - a TCP / IP protocol that defines a client / server mechanism for emulating directly-connected terminal connections.

Terminal Equipment (TE) - Terminal equipment represents the endpoint of ATM connection(s) and termination of the various protocols within the connection(s).

Throughput - Measurement of the total useful information processed or communicated by a computer during a specified time period, i.e. packets per second.

Time Division Multiplexing (TDM) - a method of traditional digital multiplexing in which a signal occupies a fixed, repetitive time slot within a higher-rate signal.

Token Ring - a network access method in which the stations circulate a token. Stations with data to send must have the token to transmit their data.

topology - a program that displays the topology of a FORE Systems ATM network. An updated topology can be periodically re-displayed by use of the interval command option.

Traffic - the calls being sent and received over a communications network. Also, the packets that are sent on a data network.

Traffic Management (TM) - The traffic control and congestion control procedures for ATM. ATM layer traffic control refers to the set of actions taken by the network to avoid congestion conditions. ATM layer congestion control refers to the set of actions taken by the network to minimize the intensity, spread and duration of congestion. The following functions form a framework for managing and controlling traffic and congestion in ATM networks and may be used in appropriate combinations:

Connection Admission Control
Feedback Control
Usage Parameter Control
Priority Control
Traffic Shaping
Network Resource Management
Frame Discard
ABR Flow Control

Traffic Parameter - A parameter for specifying a particular traffic aspect of a connection.

Trailer - the protocol control information located at the end of a PDU.

Transit Delay - the time difference between the instant at which the first bit of a PDU crosses one designated boundary, and the instant at which the last bit of the same PDU crosses a second designated boundary.

Transmission Control Protocol (TCP) - a specification for software that bundles and unbundles sent and received data into packets, manages the transmission of packets on a network, and checks for errors.

Transmission Control Protocol/Internet Protocol (TCP/IP) - a set of communications protocols that has evolved since the late 1970s, when it was first developed by the Department of Defense. Because programs supporting these protocols are available on so many different computer systems, they have become an excellent way to connect different types of computers over networks.

Transmission Convergence (TC) - generates and receives transmission frames and is responsible for all overhead associated with the transmission frame. The TC sublayer packages cells into the transmission frame.

Transmission Convergence Sublayer (TCS) - This is part of the ATM physical layer that defines how cells will be transmitted by the actual physical layer.

Transparent Asynchronous Transmitter/Receiver Interface (TAXI) - Encoding scheme used for FDDI LANs as well as for ATM; supports speed typical of 100 Mbps over multimode fiber.

Transport Layer - Layer Four of the OSI reference model that is responsible for maintaining reliable end-to-end communications across the network.

trap - a program interrupt mechanism that automatically updates the state of the network to remote network management hosts. The SNMP agent on the switch supports these SNMP traps.

Trivial File Transfer Protocol (TFTP) - Part of IP, a simplified version of FTP that allows files to be transferred from one computer to another over a network.

Twisted Pair - Insulated wire in which pairs are twisted together. Commonly used for telephone connections, and LANs because it is inexpensive.

Unassigned Cells - a generated cell identified by a standardized virtual path identifier (VPI) and virtual channel identifier (VCI) value, which does not carry information from an application using the ATM Layer service.

Unavailable Seconds (UAS) - a measurement of signal quality. Unavailable seconds start accruing when ten consecutive severely errored seconds occur.

UNI 3.0/3.1 - the User-to-Network Interface standard set forth by the ATM Forum that defines how private customer premise equipment interacts with private ATM switches.

Unicasting - The transmit operation of a single PDU by a source interface where the PDU reaches a single destination.

Universal Test & Operations Interface for ATM (UTOPIA) - Refers to an electrical interface between the TC and PMD sublayers of the PHY layer.

Unshielded Twisted Pair (UTP) - a cable that consists of two or more insulated conductors in which each pair of conductors are twisted around each other. There is no external protection and noise resistance comes solely from the twists.

Unspecified Bit Rate (UBR) - a type of traffic that is not considered time-critical (e.g., ARP messages, pure data), allocated whatever bandwidth is available at any given time. UBR traffic is given a "best effort" priority in an ATM network with no guarantee of successful transmission.

Uplink - Represents the connectivity from a border node to an upnode.

Usage Parameter Control (UPC) - mechanism that ensures that traffic on a given connection does not exceed the contracted bandwidth of the connection, responsible for policing or enforcement. UPC is sometimes confused with congestion management (see *congestion management*).

User Datagram Protocol (UDP) - the TCP/IP transaction protocol used for applications such as remote network management and name-service access; this lets users assign a name, such as "RVAX*2,S," to a physical or numbered address.

User-to-Network Interface (UNI) - the physical and electrical demarcation point between the user and the public network service provider.

V.35 - ITU-T standard describing a synchronous, physical layer protocol used for communications between a network access device and a packet network. V.35 is most commonly used in the United States and Europe, and is recommended for speeds up to 48 Kbps.

Variable Bit Rate (VBR) - a type of traffic that, when sent over a network, is tolerant of delays and changes in the amount of bandwidth it is allocated (e.g., data applications).

Virtual Channel (or Circuit) (VC) - a communications path between two nodes identified by label rather than fixed physical path.

Virtual Channel Connection (VCC) - a unidirectional concatenation of VCLs that extends between the points where the ATM service users access the ATM Layer. The points at which the ATM cell payload is passed to, or received from, the users of the ATM Layer (i.e., a higher layer or ATMM-entity) for processing signify the endpoints of a VCC.

Virtual Channel Identifier (VCI) - the address or label of a VC; a value stored in a field in the ATM cell header that identifies an individual virtual channel to which the cell belongs. VCI values may be different for each data link hop of an ATM virtual connection.

Virtual Channel Link (VCL) - a means of unidirectional transport of ATM cells between the point where a VCI value is assigned and the point where that value is translated or removed.

Virtual Channel Switch - a network element that connects VCLs. It terminates VPCs and translates VCI values. The Virtual Channel Switch is directed by Control Plane functions and relays the cells of a VC.

Virtual Connection - an endpoint-to-endpoint connection in an ATM network. A virtual connection can be either a virtual path or a virtual channel.

Virtual Local Area Network (VLAN) - Work stations connected to an intelligent device which provides the capabilities to define LAN membership.

Virtual Network Software (VINES) - Banyan's network operating system based on UNIX and its protocols.

Virtual Path (VP) - a unidirectional logical association or bundle of VCs.

Virtual Path Connection (VPC) - a concatenation of VPLs between virtual path terminators (VPTs). VPCs are unidirectional.

Virtual Path Identifier (VPI) - the address or label of a particular VP; a value stored in a field in the ATM cell header that identifies an individual virtual path to which the cell belongs. A virtual path may comprise multiple virtual channels.

Virtual Path Link (VPL) - a means of unidirectional transport of ATM cells between the point where a VPI value is assigned and the point where that value is translated or removed.

Virtual Path Switch - a network element that connects VPLs, it translates VPI (not VCI) values and is directed by Control Plane functions. The Virtual Path Switch relays the cells of a Virtual Path.

Virtual Path Terminator (VPT) - a system that unbundles the VCs of a VP for independent processing of each VC.

Virtual Private Data Network (VPDN) - a private data communications network built on public switching and transport facilities rather than dedicated leased facilities such as T1s.

Virtual Private Network (VPN) - a private voice communications network built on public switching and transport facilities rather than dedicated leased facilities such as T1s.

Virtual Source/Virtual Destination (VS/VD) - An ABR connection may be divided into two or more separately controlled ABR segments. Each ABR control segment, except the first, is sourced by a virtual source. A virtual source implements the behavior of an ABR source endpoint. Backwards RM-cells received by a virtual source are removed from the connection. Each ABR control segment, except the last, is terminated by a virtual destination. A virtual destination assumes the behavior of an ABR destination endpoint. Forward RM-cells received by a virtual destination are turned around and not forwarded to the next segment of the connection.

Virtual Tributary (VT) - a structure used to carry payloads such as DS1s that run at significantly lower rates than STS-1s.

Warm Start Trap - an SNMP trap which indicates that SNMP alarm messages or agents have been enabled.

Wide-Area Network (WAN) - a network that covers a large geographic area.

Wideband Channel - Communications channel with more capacity (19.2K bps) than the standard capacity of a voice grade line.

X.21 - ITU-T standard for serial communications over synchronous digital lines. The X.21 protocol is used primarily in Europe and Japan.

X.25 - a well-established data switching and transport method that relies on a significant amount of processing to ensure reliable transport over metallic media.

Yellow Alarm - An alarm signal sent back toward the source of a failed signal due to the presence of an AIS (may be used by APS equipment to initiate switching).

Zero Byte Time Slot Interchange (ZBTSI) - A technique used with the T carrier extended superframe format (ESF) in which an area in the ESF frame carries information about the location of all-zero bytes (eight consecutive "0"s) within the data stream.

Zero Code Suppression - The insertion of a "1" bit to prevent the transmission of eight or more consecutive "0" bits. Used primarily with T1 and related digital telephone company facilities, which require a minimum "1's density" in order to keep the individual subchannels of a multiplexed, high speed facility active.

Zero-Bit Insertion - A technique used to achieve transparency in bit-oriented protocols. A zero is inserted into sequences of one bits that cause false flag direction.

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